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CORRELATION OF GLOBAL EVENTS WITH REG DATA: AN INTERNET-BASED, NONLOCAL ANOMALIES EXPERIMENT

By Roger Nelson

ABSTRACT: The Global Consciousness Project (GCP) is a cooperative, international venture involving more than 2 dozen researchers interested in anomalies associated with consciousness. A correlation is predicted between characteristics of data from a world-spanning network of random event generators (REGs) and specified "global events" that are expected to create an unusual coherence of interest and attention. To test the prediction, special-purpose software collects data at host sites around the world continuously and sends it over the Internet to a dedicated server running software to archive and process the data. Broadly engaging global events are identified using relatively objective criteria such as intensity and depth of media coverage. The primary analyses address the distribution of deviations of the mean of the REG output during the identified events. Over the first 16 months of continuous running, the network grew to include 28 active "eggs" (as the remote REG devices are called), with host sites in Europe, the United States, India, New Zealand, Fiji, Brazil, and Indonesia. A total of 43 events had been formally specified as of January 2000. The overall cumulative chi-square for all events was 7290.6 on 6920 degrees of freedom, with an associated probability of .00096. These results indicate a small but consistent excess of deviation corresponding to the predictions.

The Global Consciousness Project (GCP) is an international effort involving researchers from several institutions and countries, designed to explore whether the construct of interconnected consciousness can be scientifically validated through objective measurement. The project builds on excellent experiments conducted over the past 35 years at a number of laboratories, demonstrating that human consciousness interacts with random

In so large a collaborative effort, the list of individuals would be very long, so I would like to acknowledge the contributions of time and energy from all the egg hosts, programmers, and analysts around the world as a group without whom the EGG project could not exist. We have received financial support from numerous individuals, including Charles Overby, Tony Cohen, Reinhilde Nelson, Michael Healy, Alexander Imich, Richard Adams, and Anonymous donors. Both Mindsong, Inc. and ICATT, The Netherlands, gave substantial discounts on the REG/RNG devices. The Institute for Noetic Sciences has provided a nonprofit home for the research activity, and the Lifebridge Foundation has provided a grant to support documentation of the project. I am grateful for the enormous contributions of talent and time by all those who have participated.

event generators (REGs), apparently "causing" them to produce nonrandom patterns (Jahn, Dunne, Nelson, Dobyns, & Bradish, 1997; Radin & Nelson, 1987). These experimental results clearly show that a broader examination of this phenomenon is warranted. In recent work, preliminary to the GCP, an array of such REG devices in Europe and the United States recorded nonrandom activity during widely shared experiences of deeply engaging events, for example, the funeral ceremonies for Princess Diana, and the international Winter Olympics in Nagano, Japan. In the fully developed project, a world-spanning array of labile REG detectors connected to computers and communicating to a central data-collection point via the Internet is designed to document and display any subtle, direct effects of people's collective consciousness reacting to global events. The research hypothesis predicts the appearance of coherence and structure in the globally distributed data collected during major events that engage the world population. Confirmation of this specific hypothesis cannot by itself establish the existence of a communal consciousness, given the complex of potential sources for anomalous effects of consciousness, but it should provoke serious consideration of the possibility that such a broadly conceived global consciousness might exist.

Starting in about 1992, a variant of the Princeton Engineering Anomalies Research (PEAR) REG experiment was implemented as a continuously running monitor, with indexing to identify times corresponding to events such as the beginning and end of runs in another experiment or the emotional presence of a small group meeting in the room. This led to a "field" version of the experiment using a laptop and battery pack for power, and later to a miniaturized version using a palmtop computer and a micro-REG. These "FieldREG" experiments differed from those in the lab most importantly by not having any assigned intentions to distort the data distributions but instead the purpose of recording deviations associated with special states of group consciousness (Nelson, Bradish, Dobyns, Dunne, & Jahn, 1996; Nelson, Jahn, Dunne, Dobyns, & Bradish, 1998). The field experiments, which began formally in 1993, were immediately interesting and soon were conceptually replicated by Dean Radin (Radin, Rebman, & Cross, 1996) and Dick Bierman (1996), using variations on the theme of identifying events and periods of time with special characteristics that might correlate with anomalous deviations of the REG or RNG data sequence. In an early cooperative effort, Bierman, Nelson, and Radin contributed data to a measurement corresponding to the jury verdict in the O. J. Simpson trial (Radin, 1997). An early prototype for a larger network of REG measurements was conducted for the Gaiamind Meditation, for which a widely publicized invitation was made by the organizers to "participate in this experiment in collective intention and share a moment of meditation and prayer for the healing transformation of the Earth." The meditation was synchronous, with a specific time period set for the local equivalent of 17:30 to 17:35 GMT. A serendipitous meeting at the Esalen Institute with the organizers of the Gaiamind project led me to set up a collaboration to gather data during the event from as many sources as possible, asking friends and colleagues with suitable equipment to run it during the defined period on January 23, 1996 (Nelson, 1997). When Princess Diana was killed in 1997, the widespread, empathetic participation during the funeral ceremonies presented another opportunity to collect data with multiple sources, distributed widely in Europe and the United States. This and related global-scale projects are described in some detail in the *Electronic Journal for Anomalous Phenomena*, or *EJAP* (Nelson et al., 1998).

These ad hoc collaborations preceded a conference in late 1997 that brought psychophysiologists and psi researchers together in Freiburg, Germany, to talk about integrating sophisticated physiological measures such as electroencephalography (EEG) into experiments on anomalies associated with consciousness. In a casual conversation during a break, the idea of a "World EEG" using REG devices sprang from the context in a remark by Dean Radin. It captured the essence of a more sophisticated version of the global consciousness measurements that already had yielded striking and potentially important results. Indeed, the technical implementation of the GCP somewhat resembles that of the EEG, a technology used to record manifestations of human consciousness in the form of brain activity measured by electrodes distributed over the surface of the head. Of course the earth is not a head, and yet, the image of a global consciousness, comprising a complex and active layer of interconnected, intelligent creatures, is compelling. One of our collaborators, Greg Nelson, suggested the name ElectroGaiaGram, or EGG, for the network, and we soon began calling it the EGG project and adopted several associated terms for internal technical communication. The analogy with EEG technology might imply that we intend to measure electrical effects, which we do not, but the name is appealing, not least because "egg," as a metaphor, is among the richest words in the English language. In this article, the acronyms GCP and EGG are used interchangeably.

Shortly after the Freiburg conference, a small working group began developing specific plans for a global network to collect data using the best available technology for assessing direct effects of consciousness. Dick Bierman, Dean Radin, and Greg Nelson (a network software expert) were among those I talked with in depth about the possibilities. Greg offered to write the backbone software for gathering and archiving the data, and John Walker, who hosts the retropsychokinesis experiment (Walker, 1997), refined and wrote most of the archiving and automated processing software. By late 1998, the EGG project had matured into an established and functioning network that began collecting archival data in August. A dedicated Web site at http://noosphere.princeton.edu has complete descriptions of all aspects of the ongoing project, including its sources, the people involved, its methodology and philosophical orientation, and a registry for the formal predictions. Graphical displays augment the tabulation of results for all individual events and summarize the findings in a current, concatenated "bottom line." This article is an introduction to the project as an experiment on consciousness-related, nonlocal anomalies.

Method

Although I take responsibility for the documentation of the project, I use "we" and "our" in this article to represent the collaborative nature of the GCP. Because the methodology for the GCP treats an unusually large and complex database generated in an unfamiliar way, it may be of value to describe the basic elements from different perspectives at the risk of some repetition. To preclude certain misunderstandings and to help define the methodology, we begin with some background notions that should be made explicit. They provide some justification for thinking that the GCP might provide useful data, while limiting the range of permissible analyses, interpretations, and possible explanations for anomalous results.

We assume that the labile, REG-based measurement system can in principle exhibit structure, either in the data sequences or in the distribution parameters, although by design an REG data stream is random, unpredictable, and unstructured. Our hypothesis is tantamount to assuming that the REG network can act as a negentropy "sink" able to interact with and actualize information that is present in the environment. We predict that this information will be exhibited as structure in the nominally random data sequence or in the parameters of the distribution. In almost all cases, the specific prediction is that the means of the data sequences for all the REGs will tend to show larger-than-expected deviations during the identified time period. This is equivalent to predicting an increase of the variance of those means. (Note that this is not the same as an increase in the variance of the trial values.)

Potential sources of structuring influence are referred to as *global events* defined operationally by means of registered predictions. Although there may appear to be a causal relationship, we do not assume that a global event or reactions to it directly influence the REG devices. Most of the relevant experimental work provides evidence only for a statistical effect in which some descriptive parameter such as the distribution mean is changed. We have little scientific evidence pointing to a direct causal linkage between an "influence" (e.g., intention or engagement) and anomalous deviations in data from experiments using this technology. In this context, we may also note that other sources of effect can be envisioned, for example, a generalized, psi-based "experimenter effect." In any case, at this point, the experiment is essentially an empirical quest for information, and although descriptions use the notion of global consciousness, the experimental methodology is capable only of detecting anomalies that appear to be correlated with events and predictions.

Understanding the methodology also requires a clear picture of the physical data-acquisition system. At each of a growing number (now about 35) of host sites around the world, a well-qualified random source[1] (REG or RNG) is attached to a computer running 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 corresponds, in the analogy with EEG recording, to a single electrode. The egg software regularly sends time-stamped, checksum-qualified data packets (each containing 5 min of data) to a server in Princeton. We assume that the eggs are synchronized to the second, although this is not always true for all eggs. Any missynchronization 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. The results of these programs and processing scripts are used to create up-to-date pages on the Web site, providing public access to the complete history of the project's results. The raw data are also made available for download by those interested in conducting their own assessments of the data or checking our analyses.

With 35 eggs running, there are over 3 million trials generated each day, and the complete database at this time occupies over 2 gigabytes of storage in a highly compressed form. 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. As an example, here is a copy of the header and the first second's data for an arbitrarily selected date, April 22, 1999, at which time 12 eggs were running. The first four lines (Type 10) show the parameters for the data collection and transmission. The next four lines (Type 11) describe the number of eggs and the time and date for the data. The next line (Type 12) gives the identification numbers of the active eggs, and the last line (Type 13) gives the data for the first second of the day.

```
10,1,10,"Samples per record"
10,2,10,"Seconds per record"
10,3,30,"Records per packet"
10,4,200,"Trial size"
11,1,12,"Eggs reporting"
11,2,924739200,"Start time",1999-04-22 00:00:00
11,3,924825599,"End time",1999-04-22 23:59:59
11,4,86400,"Seconds of data"
```

[1] Three sources are in use: The PEAR portable REG, the Orion RNG, and the Mindsong Microreg. All three 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. An unbiased mean is guaranteed by hardware or software XOR logic.

12,"gmtime","Date/Time",1,28,33,37,101,103,1000,1003,1005,1021,
1022,1023
13,924739200,1999-04-2200:00:00,105,93,100,106,112,91,104,93,99,
103,110,100

The hypothesis for REG experiments in general and for the EGG project in particular is that the mean value of the nominally random numbers will be shifted—in other words, that the output of the REG device will not be random as expected but will show a bias. In some experiments (in the lab), an intention is assigned to shift the mean high or low, but in the field experiments, including GCP, there is no intention. Therefore, a deviation in either direction away from what is expected qualifies as anomalous and interesting. The most convenient way to quantify these deviations is by (a) normalizing them to *z*-scores, (b) squaring the *z*-scores, and (c) comparing the result against its proper theoretical distribution, which is the chi-square. There are a number of reasons why this is convenient, but the important ones are as follows: (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, and (c) chi-square values are additive, so the results from separate eggs or minutes or occasions can easily be combined to give an overall picture.

The database consists of a large and continuously growing matrix of trials, each of which has an expected mean of 100 and expected standard deviation of 7.071. Deviations from the expected mean can be converted directly to (0,1) normally distributed *z*-scores. Assuming N eggs in the network, there will be N *z*-scores for each second, and these can be combined across eggs using the Stouffer method ($Z_e = \sum(z_i) / \sqrt{N}$) to form a single *z-score* representing the composite deviation of the mean at any given moment. Such a composite *z-score* can be used as a basic element in the measure of an anomalous effect on the data by accumulating the second-by-second *z-score*s generated during the event of interest. This is done by summing the squared *z-score*s over the specified period and comparing them with the appropriate chi-square distribution.

There are a number of alternative methods that might be defined. For example, we could use the sum of squared *z-score*s across the N eggs for 1 s. This would represent the total unsigned deviation across eggs as a chi-square-distributed quantity with N degrees of freedom. This measure of the variance of the deviations of the mean across eggs obviously would give a different result from the composite *z-score*. Although a few alternative methods have been used to test individual predictions, the vast majority of formal analyses specify the composite Z procedure first described, and most of the discussion here is based on that procedure. It should be emphasized that a prespecified method of analysis is a necessary part of the prediction.

The primary focus of the GCP analysis is thus on tests for anomalous shifts of the mean during periods of time specified in formal predictions.

As noted, the standard test for such departures from expectation compares the chi-square of the composite deviation across all eggs during a specified event against theoretical expectation. This composite chi-square is a sum of the squared *z-scores* for all predefined segments (which may be seconds, minutes, or another prespecified block of time). It tests the question whether there is a tendency for the composite of the trial values across the eggs to show increased deviation from expectation during the specified times. In other words, it tests whether there is unusual consistency in the behavior of the eggs moment by moment over the period of interest. The hypothesis is posed as a one-tailed prediction, and decreased chi-squares, even if significant, are not taken as evidence for the hypothesis. The theoretical expectation as a comparison standard is itself tested by examining the distribution of calibration data and by examining the results of a resampling procedure in which segments of the same size as the "active" segment are drawn randomly from "nonactive" data to create an empirical distribution of "chance" chi-squares against which the actual chi-square can be compared.

The formal hypothesis we test in the standard procedure is that the composite variation of the distribution means of data sequences recorded from multiple REG's during broadly engaging global events will deviate from expectation. In summary, the definitions for this hypothesis are as follows:

1. The variance measure is the chi-square-distributed sum of squared, normalized deviations (*z-scores*) of segment means from chance expectation.
2. The distribution means are those of data segments from each continuously running REG, recorded during the specified time period. The length and the number of subsegments within the period are prespecified.
3. Within the segments (which may be single seconds, requiring no compounding), the mean deviation for each egg is compounded using Stouffer's method, and then the mean deviation across eggs is compounded.
4. The identification of "broadly engaging global events" is made by the experimenters prior to the event or prior to any examination of the data in the case of unpredictable events. The identifications are based on relatively objective criteria such as intensity and depth of media coverage and to some degree on intuition bolstered by previous experience.

It should be noted that the formal analysis described is not the only one that might be useful. For example, the general hypothesis might also be tested by looking at interegg correlations, which we would expect to be greater whenever a powerfully engaging event brings large numbers of people to a common focus. Preliminary work in this vein shows promise but is not detailed here. The main assessments of the general hypothesis continue to be based on the identification of global events and tests of the distribution parameters of corresponding data.

In specifying the GCP predictions and analysis, we used simple rules and assumptions. For example, correlations are judged on the assumption that any anomalous effect on the REGs will be concurrent with the event but unaffected by distance between the REG and the locale of the event. The following is a listing of some of the issues that may be relevant.

1. There are important differences between ordinary physical space and time and consciousness space and time. This promotes consideration of the roles of engagement, emotion, attention, and intention; the effects of attitudes of experimenters and other interested parties; and the functional effect of the experimental question and design.
2. For the spatial dimension in the EGG project, we make the basic assumption that no ordinary attenuation rule (say, $1/R^2$) is applicable. However, the project design permits assessment of the effect of ordinary proximity by comparing correlations of an event with relatively local REG data against correlations with data from more removed locations.
3. For the time dimension in the EGG project, we limit the protocols to temporally local assignments and questions. This means, by assumption, that we expect to find on-time effects only; it specifically precludes interpretation of displacements and temporally nonlocal effects.
4. For the experimental questions, our essential concern is to make reliable, veridical, and scientific assessments bearing on several fundamental questions that have a natural order: (a) Is there structure in the nominally random data? (b) What are we able to correlate with the structure? (c) How is this related to anomalous field effects of group consciousness and to evidence for a global consciousness? (d) How does the structure illuminate our understanding of consciousness? (e) What is implied about the role of consciousness in the world?

Only the first two of the specific questions in Point 4 can readily be assessed with scientific rigor. Thus, the methodology is designed with a simple focus: to determine whether the REG data exhibit structure that is correlated with specified global events in the world. At the same time, we have tried to ensure that it will be possible to address at some point the larger issues and implications.

On the most general level, we predict that there will be some order in the distributed matrix of data. Because the design of equipment and protocols predicates that the data will be random, there should be no temporal or correlational structure beyond that expected by chance. Therefore, the appearance of such structure, even in the absence of perceived events with importance to us, may be an indication of the effect we hypothesize and may tentatively imply an effect of unified global consciousness. We expect certain multidimensional analyses to help identify global structure and distinguish it from effects of mundane physical sources, although at this point we are limited to very simple analyses of mean and variance shifts.

Procedure

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 experiments, it appears that broadly engaging, emotionally salient events and situations are among the conditions that tend to be correlated with anomalous interactions and significant deviations in the REG datastreams. Similarly, prior experiments indicate that mundane or chaotic situations have little effect or may actually be correlated with suppressed deviation. Although these are subjective prescriptions, we can create operational definitions that render them reasonably well. We have set the criteria for global events restrictively, to identify very few occasions with the broadest scope and impact for a large proportion of people around the world. Each prediction identifies the period of time during which a deviation is expected in the data, and it provides most of the information needed for analysis, including the details of the data processing and statistical calculations by which the experimental hypothesis is to be tested. 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 some unusual "cosmic" events, such as major conjunctions, comets, and solar eclipses. Finally, there is a large category of unpredictable events, such as major earthquakes, the fall of the Berlin wall, the assassination of Israeli Prime Minister Rabin, or the detonation of atomic weapons in India and Pakistan, that gather worldwide attention. The times we use for archiving the data, and hence for the predictions and analyses, are registered unambiguously in coordinated universal time (UTC).

A major source of predictions is inevitably the international news services such as CNN and BBC. The first report of a major story with global scope is readily identified, and the timing of the event is usually available from the reported story. Relatively local events may also be considered for predictions if they involve powerful engagement of many people in some part of the world. In principle, measurements and computations can compare local and global scales. For example, the solar eclipse in August 1999 was obviously more exciting for those who actually were in the path, and analysis showed that the data from eggs that were in the path had highly significant deviations compared with data from other eggs (DeBeaumont, 1999). Organized efforts to engage people in large-scale, coordinated meditations and prayers may also be included as candidates for global event status. 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.

There are two major types of segment definitions, one referring to the actual event and one that looks to the developing world consciousness of the event. The first is perhaps best envisioned as representing a "psychic" reaction that would occur only if there were something like an independent global consciousness, or alternatively, as a widespread, immediate effect of an intense local reaction. The second type represents a more ordinary accumulation of engagement on a conscious level of large numbers of people because of media coverage. The degree of media coverage varies greatly in different parts of the world, and for different kinds of events, but we nevertheless expect that it can provide a rough metric by which potentially effective events may be identified and defined.

For each case, there are certain obvious procedures leading to the required data-segment specification. The beginning and end of a time period may be established by the events as reported in the world news or by a public definition of the event. For example, the beginning and end times for a sporting event that is broadcast live can be recorded from the broadcast. In some cases, there is only a point in time, not a duration, for the actual event (e.g., the time of the murder of Prime Minister Rabin). For such an event, we arbitrarily predefine a period that we will assess, for example, 10 min or a half hour surrounding the point event. For a unique event such as Princess Diana's funeral, news sources may publish a schedule. The duration of an event, when its end is not specified in the news source, has to be arbitrarily defined prior to examination of the data. Similarly, the duration of the period during which the news spreads to engage many people has to be arbitrarily specified. There is typically some delay, depending on the nature of the event, between its occurrence and its penetration into a widespread global consciousness. For example, the news of the crash that killed Princess Diana first appeared on public media about 7 min after the crash, but, because the time was very early morning at the scene, the spread of the news in Europe took several hours despite the intensity of developing interest. The GCP specification for an analysis of an aftermath period is inevitably arbitrary, but, based on experience, we typically specify 3 or 4 hours beginning with the event itself. In all formal predictions, the detailed specification is entered in the prediction registry before any examination of the data.

We calculate the mean, variance, and *z-score* across eggs for each segment, properly treating missing values.[2] This yields a single time series of parameters representing the composite egg behavior that can then be used in various analyses and explorations. Choosing whether to block the data is usually arbitrary, but it has to be specified in advance rather than by inspection of the results. In some cases, there are specific reasons to use blocking. For example, to create a manageable dataset for 6 days worth of seconds, we may choose to use 15-min blocks. For some analyses, like the interegg correlations, it is always necessary to block the data to have a viable sample. The following description is a detailed example of the procedure beginning with acquisition of the raw, second-by-second data and continuing through the calculation of a canonical chi-square statistic. Blocked data are treated analogously.

1. An REG produces random bits at high speed for collection via the egg-host computer's serial port. The data are transmitted over the Internet to a central server for archiving and processing.
2. Each egg-site records these data as "trials" at one per second, summing 200 bits for one trial. The 200-bit sums have expected mean = 100 and standard deviation = 7.071.
3. The mean deviation from expectation for a single trial across all eggs, or the mean of a block of trials across eggs, is normalized as a *z-score*.
4. The *z-score* is squared, yielding a chi-square-distributed quantity with 1 degree of freedom representing a single trial or a block of time specified in the prediction.
5. Because chi-squares are additive, we may sum across eggs and across blocks of time.
6. The total chi-square represents the deviation for the predicted period of time. It has degrees of freedom equal to the number of segment *z-scores*.
7. This is compared with the appropriate chi-square distribution to yield a chance probability.

[2] Data are collected continuously at all host sites over months and years. There are naturally 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 used.

Control data are needed to establish the viability of the statistical results from "active" data generated during the specified events. 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, including a logical XOR that guarantees zero deviation in the long run. In the simplest form, the logical XOR compares the random sequence with an alternating 1,0 sequence and registers each match as a "hit," thus eliminating, to first order, any bias of the mean. The design is then empirically tested by thorough device calibration, and finally, resampling procedures are used to examine the distribution of parameters in the actual data. The resampled control data are expected to produce chance results because by hypothesis no engaging event can be specified. See Nelson et al. (1998) for more detail and examples of the resampling procedure. We have recently added 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 pseudorandom algorithm. Details are beyond the scope of this article, but the control analysis essentially duplicates the formal database results using the pseudorandom database. Thus, although a single comparison of active and pseudo results would not be an adequate control procedure, the overall results combined across all formally defined events will provide a sufficient sample. Although the active data show a highly significant cumulative deviation from expectation, the corresponding analysis using the pseudorandom clone data should not differ from chance expectation. 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 resampling of appropriate control and calibration data.

Results

A sample of individual cases will provide some familiarity with the type of events in the formal database and the results of typical analyses. The overall evidence for the GCP hypothesis comprises an accumulation of outcomes from all formally defined global events. The Appendix presents a table detailing the results for individual events, and Table 1 in the *Composite Results* section summarizes the results across all events. The complete current database can be examined in the GCP Web site presentation of results at http://noosphere.princeton.edu/results.html.

The first formal prediction for the EGG project was made in August 1998, while I was traveling in Halifax, Nova Scotia, Canada. It is an interesting coincidence that the occasion was the annual convention of the Parapsychological Association. The prediction concerned the embassy bombings in Nairobi and Tanzania, on August 7, 1998, at 07:35 UTC, which I read about on the following day. I immediately identified this as a candidate global event because I think such terrorist attacks exemplify a tearing of the social fabric that would shock a global consciousness temporarily, violating, as they do, long-honored principles of civilization. For this particular event, we had only a general outline for the prediction strategy. It proposed an examination of the data for a half-hour period surrounding the point event and an aftermath period of several hours during which the news would spread and the world would become conscious of what had happened.

At that time we did not have sophisticated analytical processing capabilities, but a hand calculation could be made using the automatically generated *z-scores* for 15-min blocks. The analysis was based on data from three eggs and looked at the event period from 07:15 to 07:45, and at a 3-hr aftermath period from 07:15 to 10:15. The associated probabilities indicated significant deviations for both time periods (the second includes the first so they are not independent). For the short period marking the event itself, the result was a chi-square of 18.039 on 9 degrees of freedom, with p = .035. For the aftermath, inclusive of the event, the result was chi-square = 69.536, on 36 degree of freedom, with p = .00066. Later, with more sophisticated analytical tools available, it was possible to examine the data in more detail. We found that, because the network was still somewhat fragile, there were brief periods during which the eggs were not all running, so the block *z-scores* were based on contributions during some intervals from only one or two of the eggs. Nevertheless, the original calculations were confirmed, and the following graphical representation (Figure 1) of the analysis shows the striking accumulation of positive deviations in the chi-square across the 3-hr period following the bombing.

Needless to say, such a result in our first formal test of the concept was encouraging. We proceeded with building the network and making predictions for identifiable future global events. One of the simplest and most obvious targets was the celebration at New Year's Eve, in which there always is great interest and participation practically everywhere in the world. We made a prediction that the period of 10 min surrounding the midnight transition to the New Year, 1998 to 1999, would show a deviation in the data summed across all time zones. The entry in the prediction registry reads, in part: "RDN, pred. late August, 1998: New Year Celebrations: Expect peak deviation at midnight ± 5 minutes. Expect correlation structure to proceed through the 24 hour period." This required a more complex analysis analogous to signal averaging across epochs using the second-by-second raw data. The result was highly significant, showing a monotonic trend across the 24 periods, with a chi-square of 136430, on 135000 degrees of freedom and p = .0031. At this time, my understanding of time zones was unsophisticated, and the analysis used a simple model of 24 time zones for 24 hr. Figure 2 shows the result for this analysis graphically.

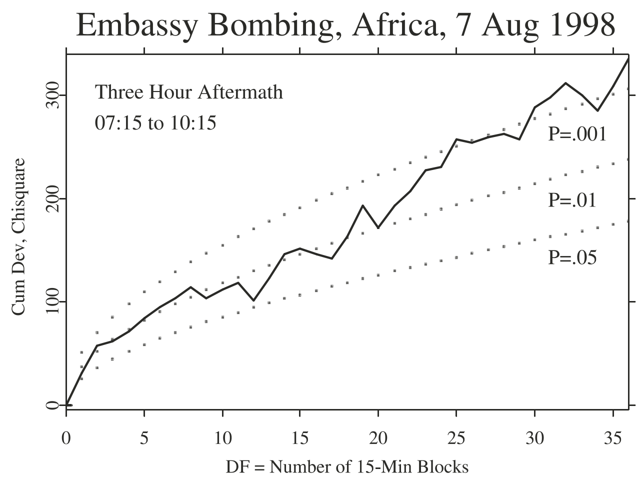

Figure 1. Results for the first formal "global event" prediction, the embassy bombings in Africa, August 7, 1998. Composite data for 15-min blocks are displayed as a cumulative deviation of chi-square minus degrees of freedom. Chance expectation is for a random walk with a horizontal trend at zero deviation. The dotted parabolas show the locus of probabilities as the data accumulate.

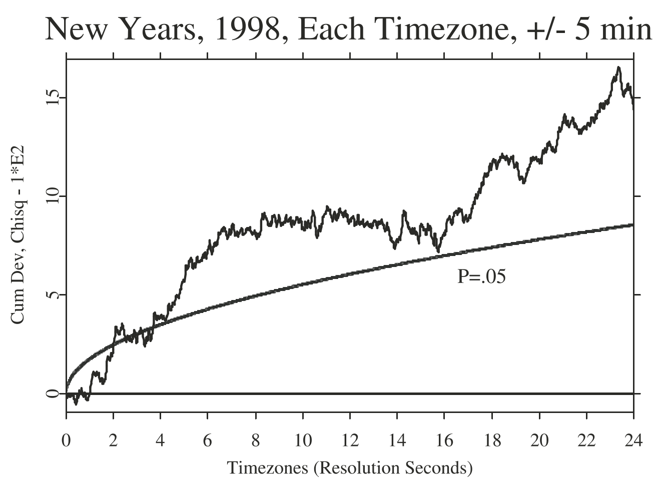

Figure 2. New Year's Eve celebrations, 1998–1999. The composite Z^2 across 9 eggs for each second is displayed as a cumulative deviation of chi-square minus degrees of freedom, concatenated across 24 time zones. Chance expectation is for a random walk with a horizontal trend at zero deviation. The smooth parabola shows the locus of .05 probability as the data accumulate.

There were other preplanned analyses of these data, including one by Dick Bierman predicting differences between the European and U.S. eggs, which yielded a positive but nonsignificant *p*-value of .199. Richard

Broughton took seriously the analogy with EEG technology and considered the GCP data as if it were electrical data from a brain. He set up an analysis to compare the analog of an "evoked response" for New Years during the times (actually time zones) when there is a great deal of attention to the celebration ("Maxi-Celebration"), with other places where there is little celebration ("Mini-Celebration"). The composite deviation for the former yielded a p-value of .028 and for the latter, $p = .233$. The difference between these was taken as the formal outcome and yielded a p-value of .122. For more detail, see Broughton (1999) and the presentation on the GCP Web site at http://noosphere.princeton.edu/results_p3.html.

As is the case in all statistics-based anomalies research, some predictions are confirmed and others, apparently equally justified, are not. For example, an analysis of the 1-s data for the Y2K New Year transition, which we predicted to replicate that of the preceding year, showed only a modest deviation, with a p-value of .237. Yet the same data, analyzed according to a prediction by Dean Radin that the variance of trial-score means across the individual eggs would decrease as midnight approached, strongly confirmed his expectation. Though it was a proper prediction made prior to examining the data, Radin did several analyses to home in on an "optimal" expression of the outcome, necessitating a Bonferroni adjustment. Even with a factor of 10 to compensate for the selection from multiple analyses, the chance probability for the focused reduction of variance is on the order of 1 in 1,000. I did a number of independent analyses to explore the generality of Radin's work from different perspectives. One of these explorations is shown in Figure 3, which displays

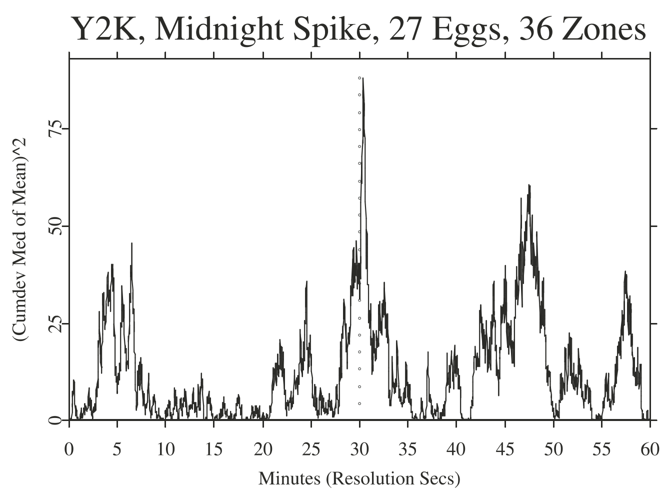

Figure 3. An exploratory analysis complementing formal assessments of the Y2K transition time. The figure displays superimposed, hour-long epochs surrounding midnight, 1999 to 2000. The data are the squared cumulative deviation of the median value across 36 time zones for the mean across 27 eggs.

changes in the squared deviation of the mean trial value across eggs over the time surrounding the Y2K transition. This is a cumulative sum of the squared median deviation of the mean from empirical expectation, and it reveals, as did Radin's analysis, a striking spike at midnight. A permutation analysis of 4,000 random arrangements of the same data found that although many cases had a higher spike somewhere in the range, few were so exactly focused on midnight. The combined probability, based on the permutation distribution, was .020.

In a substantial number of cases, there is no apparent effect at all. For example, we looked at the Clinton impeachment aftermath, and it suggests that political happenings, even if they seem quite important, may not produce the conditions for an effect on the EGG network. Although most people were equivocal about the meaning of the Clinton impeachment saga, virtually everyone, especially in the United States, paid some attention, so it seemed appropriate to predict an effect in the period following the critical Senate vote of acquittal. In fact, as can be seen in Figure 4, there was no persistent trend, and the *p*-value associated with this event was .417.

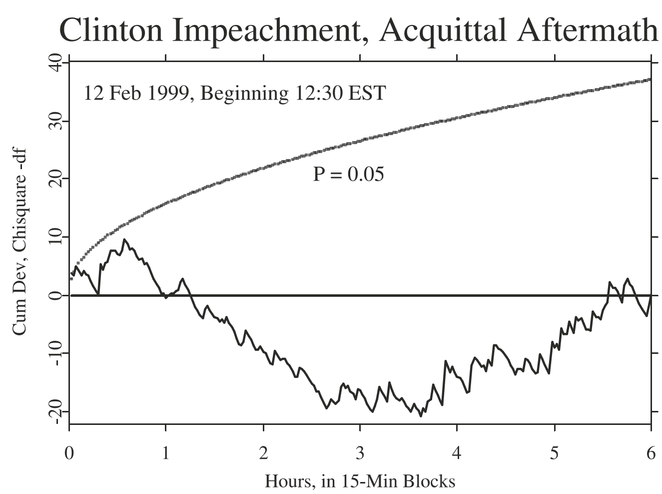

Figure 4. Cumulative deviation of data from the EGG network during a 6-hr period beginning with the announcement of acquittal by the U.S. Senate in the impeachment trial of President Clinton. Chance expectation is for a random walk with a horizontal trend at zero deviation. The smooth parabola shows the locus of .05 probability as the data accumulate.

Composite Results

As of the beginning of 2000, the GCP had made and analyzed 43 predictions under the formal protocol. Table 1 shows the concatenated results for these as well as for a subset that were identified prior to analysis with a "high" confidence rating. In the full database, the chance probability of such a large accumulated chi-square is less than 1 in 1,000. (Note that for the composite calculation across all formal events, those with very large degrees of freedom are normalized to a manageable 600 degrees of freedom using the qchisq function in Splus.)

TABLE 1
COMPOSITE RESULTS FOR 43 FORMAL TRIALS

Category	Expectation	χ^2	*df*	*p*
All events ($N = 43$)	Positive trend	7290.6	6920	.00096
High subset ($N = 20$)	Significant dev.	3560.8	3296	.00072

For details on the individual global events, a table with an entry summarizing each of the events may be found in the Appendix, and a complete, up-to-date table is available on the GCP Web site at http://noosphere.princeton.edu/results.html. Most of the table entries on the Web site also contain a link to a complete description of the formal analysis for the event, and in many cases, further explorations and investigations that provide context for the formal prediction.

The individual results can be cumulated over time graphically to provide a summary of the GCP experiment as a whole. Figure 5 shows the accumulating excess of the chi-squares over their corresponding degrees of freedom (heavy black line). It culminates in a composite probability for the whole array of events that is on the order of a few parts in 10,000. The dotted lines show the .05 and .01 probability envelopes for the cumulative deviation from chance expectation, which is plotted as the horizontal black line at zero deviation. The figure also shows the results for 10 simulations calculating the cumulative deviation using random chi-squares generated from the appropriate degrees of freedom (open circles). The composite probability for the random data is a nonsignificant $p = .123$, and the simulations provide a background against which the actual data clearly stand out.

DISCUSSION

The accumulating evidence for an anomalous effect on REG devices placed around the world is strong. There is a small but highly significant deviation from theoretical expectation for a random distribution of 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. There are alternative explanations for 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 I assume that such an "experimenter effect" may contribute to the overall result. However, the characteristics of the individual events and their correlated outcomes strongly suggest that a broader and more

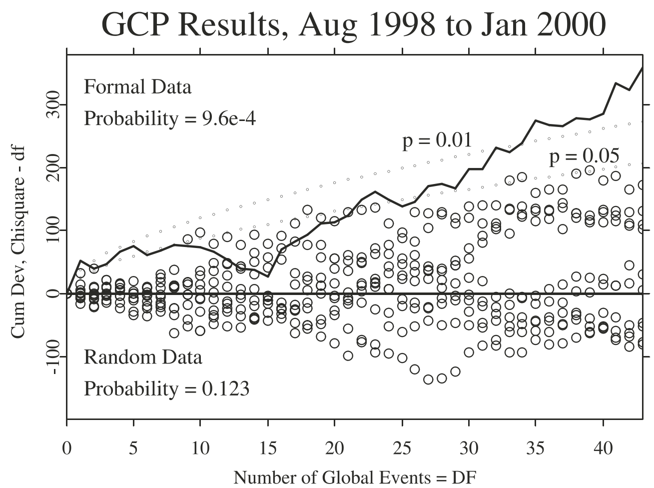

Figure 5. Concatenated results for 43 formal predictions. The jagged black line shows the cumulative sum of the 43 chi-squares minus their degrees of freedom. The dotted parabolas show the locus of the .05 and .01 chance probabilities as the data accumulate. Ten random simulations of the cumulative chi-square trace are shown as open circles.

comprehensive source is a major contributor. 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 were both the most prominent international news items when they occurred. Yet, the result is completely different, that is, the result is definitely not correlated with the experimenters' expectations. In the full database of formal and exploratory analyses, there are many instructive examples. 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; and the New Year's Eve event, which clearly meets the criterion for global interest as well as the experimenters' expectations, appears to produce quite different results each year, but the data around midnight are nonetheless unmistakably structured, not random.

In any case, the formal data from the EGG network definitely show an anomalous overall deviation that is consonant with our general hypothesis. Many of the individual events have results that, in addition to their technical, statistical contribution, also exhibit patterns that are subjectively striking, perhaps even meaningful. We look for further insight from an aesthetic and subjective perspective complementing the hard-edged, scientific analysis, in nonformal "Exploratory Studies," which are presented in a special section of the GCP Web site at http://noosphere.princeton.edu/res.informal.html. These explorations also include attempts to learn more about optimal blocking and time periods for cases that show effects in the formal analysis, and we look for parameters other than shifts or variability of the mean that may be useful. There are also a number of explorations for events we do not know how to categorize, and some post hoc specifications and analyses seeking a better understanding of what comprises an "interesting" global event.

An independent analysis of egg intercorrelations embodying a completely different perspective also shows evidence of anomalous correlation. Instead of a focus on individual events, the intercorrelation hypothesis predicts that if there is some nonlocal effect on the data generated by the individual eggs, they will show correlated behavior on an intermittent basis corresponding to unidentified common sources of influence. To fully detail this analysis is beyond the scope of this article, but details may be found on the GCP Web site (Mast, 2001). In brief, all possible egg intercorrelations were calculated (there are about 250 million over the 2 years). The absolute correlation $|r|$ is expected to be greater than the threshold $r0$ exactly half the time. For each cross-correlation, counts were recorded for "hits" where $|r| > r0$ and for "misses" where $|r| < r0$. Theoretically, the number of hits and misses should be exactly equal, and the probability of obtaining a given number of hits can easily be computed. For 1999, the number of hits of this kind was much larger than expected by chance, with $Z = 2.549$, $p = .0054$. For 2000, the result is less impressive, with $Z = 1.106$, $p = .134$, but the combined result for the 2 years is $Z = 2.283$, $p = .0112$. Because this analysis was based on earlier versions, the 1999 result in particular must be confirmed by future analyses. We will continue to assess the intercorrelation to generate a longer history and greater clarity. In its present status, the egg intercorrelation analysis constitutes a complement to the formally defined analysis, and its generally positive result increases our confidence in interpreting the primary results.

By any of the measures we have applied, there is good evidence for anomalous correlations in the data from the EGG network, either with defined external events or with unknown sources of nonlocal influence. The effects are statistical in nature and are similar to what is seen in laboratory research and in field applications of the REG technology. The similarity raises the question why the effect is not much stronger, given the large number of REG devices and the very large numbers of people who may be regarded as sources. In fact, we have 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 a strongly "resonant" bonded relationship (Dunne, 1993). The same general principle applies to the data reported here, namely, the effects are dependent on the nature of the situation, including obviously subjective aspects, and not merely 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. However, 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 interesting events.

Conclusion

The GCP is an extension of laboratory REG experiments and nonintentional 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 may also be instructive to attempt correlations with other variables such as the geophysical and cosmological data that have shown some promise in parapsychological research. Thus far, the main focus of the project has been on the question 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 anomalous departures of the data from expectation. Although it may well be modulated by experimenter expectations, the most likely source and the most consistent correlate of the apparent effects is the relatively high coherence of widespread attention during events with a strong global focus.

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Appendix

Results as of January 2000

There were 28 active eggs in January 2000, in Europe, the United States, India, Fiji, New Zealand, Indonesia, Brazil, Africa, and Australia. The hypothesis is that our instruments (the "eggs") will show anomalous deviations associated with global events when there is widespread participation or reaction to the event and we can expect large-scale coherence and resonance. As of January 2000, we had made 43 formal predictions, based on intuitive grounds educated by accumulating experience. The Prediction Registry on the GCP Web site provides details of the specific predictions, which are made prior to the event if possible (noted in the table with an asterisk in the "Source" column) and before any examination of the data in all cases. The results indicate strong correlations in some cases and virtually none in others, but overall, there is a significant accumulation of evidence for the hypothesis. Summaries of the results are given in Table A1. The first column, "Event Description," identifies the event and the date; the "Source (Effect)" column indicates who made the prediction and gives an estimate of the expected effect size based on previous experience. The "REG" column gives the number of active nodes, and the "Resolution" column indicates the blocking interval for analysis. The last three columns give the chi-square, degree of freedom, and the chance probability for the outcome.

TABLE A1
RESULTS FOR INDIVIDUAL PREDICTED EVENTS

Event Description	Source (Effect)	REG	Resolution	χ^2	*df*	*p*
1. Embassy bombings, 980807	Nelson (high)	3	15 min	69.5	36	.00066
Omagh bombings, 980815	Nelson (high)	4	15 min	39.5	48	.805
U.S. airstrikes, Afghanistan, 980820	Nelson (low)	6	15 min	14.1	12	.293
Swissair 111 crash, 980903	Nelson (high)	5	15 min	75.0	60	.092
McGwire, record homerun, 980908	*Nelson (high)	9	15 min	22.0	18	.230
5. Casitas collapse, 981030	Nelson (high)	5	15 min	5.4	10	.863
Casitas flooding, 981030	Nelson (high)	5	15 min	66.2	60	.272
Global Peace Vigil, 981113	*Nelson (low)	5	15 min	12.2	10	.274
Iraq, 11th-hr decision, 981126?	Nelson (high)	4	15 min	46.942	48	.516
10. World Peace Prayer, 981210	*Nelson (med)	7	15 min	26.402	28	.551
Iraq bombing, 981217	Nelson (med)	7	15 min	24.6	28	.651
House votes impeachment, 981219	*Nelson (med)	7	15 min	71.9	84	.824
Christmas Eve, UTC, 981224	*Etzold (med)	8	15 min	52.5	64	.847
Christmas Eve, EST, 981224	*Etzold (med)	8	15 min	62.4	64	.533
15. Christmas Eve, PST, 981224	*Etzold (med)	8	15 min	55.6	64	.764
New Years, 24 hr, 981231 (1)[a]	*Nelson (high)	9	1 s	699	600	.0031
New Years, Times Square, 981231	*Nelson (high)	9	1 s	629.9	600	.192
New Years, Euro vs. U.S., 981231	Bierman (high)	9	1 s	69.0	60	.199
New Years, Maxi vs. Mini, 981231	Broughton (high)	9	1 s (diff)	4.2	2	.122
20. Senate acquits Clinton, 990112	*Nelson (med)	10	15 min	41.2	40	.417

TABLE A1 (CONTINUED)
RESULTS FOR INDIVIDUAL PREDICTED EVENTS

Event Description	Source (Effect)	REG	Resolution	χ^2	*df*	*p*
Columbia, Armenia Quake, 990125	Nelson (med)	9	15 min	157.7	144	.205
Nato bombs Yugoslavia, 990324	Nelson (high)	12	15 min	65.7	48	.045
Praying for Peace, 990403 to 0501	*Taylor (med)	Var	1 min	383.11	360	.193
Littleton school tragedy, 990420	Polk (med)	11	15 min	118.067	132	.801
25. Autonomy, Israel, PLO, 990505 (2)[b]	Kraak (high)	17	15 min	12.585	17	.763
"Peace at Last," Headlines, 990610	*Nelson (med)	17	15 min	212.74	204	.323
Yugoslavia war ends, Milosevic, 990610	*Nelson (med)	17	15 min	239.84	204	.042
JFK Jr. crash, 30 min, 990717	Nelson (med)	21	15 min	43.91	42	.391
JFK Jr. crash, 3 hr, 990717	Nelson (med)	21	15 min	243.48	252	.638
30. India, train crash, 990801 (3)[c]	Nelson (med)	17	15 min	302.94	256	.023
Solar eclipse, 990811	*Nelson (med)	20	15 min	239.15	240	.503
Turkey, earthquake, 30 min, 990817	Nelson (high)	20	15 min	62.684	40	.012
Turkey, earthquake, 4 hr, 990817	Nelson (high)	20	15 min	291.6	304	.685
Japan, nuclear accident, 990930	Nelson (high)	21	15 min	98.25	84	.137
35. Billion Person Meditation, 991025	*Nelson (med)	21	10 min	91.0	63	.012
Typhoon, India, 2 hr, 991029	Nelson (med)	22	15 min	166.15	176	.691
Typhoon, India, 24 hr, 991029-30	Nelson (med)	23	15 min	531.1	533	.515
Earthquake, Turkey II, ± 2 , 991112	Dunne (med)	21	15 min	359.0	336	.186
Full moon, solstice, 4.8 min, 991222	*Fournier (med)	25	1 s, epoch	284.62	288	.545

TABLE A1 (CONTINUED)
RESULTS FOR INDIVIDUAL PREDICTED EVENTS

Event Description	Source (Effect)	REG	Resolution	χ^2	*df*	*p*
40. New Year, Y2K, 24 hr, 19991231	*Nelson (high)	28	1 s, epoch	624.41	600	.237
New Year, Y2K, Var, 19991231 (4)[d]	Radin (high)	27	1 s, epoch	10.42	1	.0013
Hi vs. Lo populations, Y2K, 991231[e]	*Nelson (high)	27	1 s (diff)	577.22	600	.741
Just A Minute, 1-min epoch, 20000101	*Srinivasan (high)	27	1 s, epoch	88.33	60	.010

Note. UTC = coordinated universal time; EST = Eastern Standard Time; PST = Pacific Standard Time; PLO = Palestinian Liberation Organization.
[a] All cases with very large degrees of freedom are normalized to 600 df. For example, the analysis of this event used a 1-s block size, resulting in a huge number of degrees of freedom in the original form. Because the chi-square statistic is properly additive, an event's contribution is simply proportional to its computed probability, allowing the calculation to be redone as a superposition of the 10-min segments; this results in 600 df.
[b] The Kraak prediction for the Autonomy ceremony originally had the incorrect day, 990504. The table value now reflects the correct day.
[c] The prediction for this event, the train crash in India, was made after hearing a general description of an analysis, and hence arguably should not be included in the "bottom line" in the summary table. If excluded, it would change the result slightly in the negative direction (e.g., $p = .0008$ instead of .0006). In this case, as occasionally happens, the ratio of degrees of freedom to the number of eggs is not a round number because some eggs dropped out or were added during the event.
[d] Radin's analysis yields $Z = -3.662$, and $p = .00013$. A Bonferroni correction of a factor of about 10 is required, resulting in $p = .0013$ in the table. Radin envisioned an "impulse" of coherence at midnight, so his hypothesis is assessed by a reduction of variance peaking at that time. This spike was assessed by a one-tailed *p*-value, and the corresponding chi-square with a single degree of freedom was computed.
[e] The difference between high and low population time zones was calculated by Nelson, based on Broughton's similar analysis for the preceding year but using 36 time zones.