Global Consciousness Project:
An Independent Analysis
of
The 11 September 2001 Events

by

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Abstract

We have conducted an independent analysis of the worldwide network of random number generators called EGG's by the Global Consciousness Project (GCP) personnel. At the time we found direct contradictory statements with regard to the proper protocol between a published account and an account posted on the GCP web site http://noosphere.princeton.edu. (Subsequently, this inadvertent ambiguity has been corrected.) We provide, nonetheless, our analyses of both proposed methods.

The formal test hypothesis according to the published protocol, namely that there would be at least a significant deviation (i.e., p = 0.05) of the accumulation of χ^2, which was derived from squaring the Stouffer's Z across valid EGG's at each second, was satisfied. However, we show that the choice was fortuitous in that had the analysis window been a few minutes shorter or 30 minutes longer, the formal test would not have achieved significance. We discuss the implications of this finding.

The alternative analysis based upon the instructions posted on the GCP website, however, showed chance deviations throughout.

We also provide verification of a separate analysis posted by Dr. Dean Radin, but we differ markedly with regard to the posted conclusions. Using Radin's analysis, we do not find significant evidence that the GCP network's EGG's responded to the New York City attacks in real time. Radin's computation of 6000:1 odds against chance during the events are accounted for by a not-unexpected local deviation that occurred approximately 3 hours *before* the attacks.

We conclude that the network random number generators produced data consistent with mean chance expectation during the worst single day tragedy in American history.

Background

It is beyond the scope of this paper to describe the details of the worldwide collection of random number generators, called EGG's that are part of the Global Consciousness Project (GCP). They can be found at http://noosphere.princeton.edu and in Nelson (2001). It is, however, appropriate to provide a very brief overview of this interesting study.

The GCP's experiment comprises a network of true, not pseudo, random number generators distributed widely around the world. Each of approximately 38 hardware EGG's generates one trial of 200 binary bits each second, where the probability of obtaining a one or a zero is equal and equal to 0.5. The expected number of one's is therefore 100 and the expected standard deviation is $\sqrt{50}$. The data from each of these generators is up-loaded in 5-minute segments as Internet connectivity permits to a server in Princeton, saved, and made available to anyone. The fact that the GCP operates in such an open way is a testimony to the integrity and curiosity of those involved.

The experimenters of the GCP have broadly hypothesized that certain events, which are generally seen to be important, will cause changes in the random data produced, which can be detected by the appropriate statistical tests. The project has been running for three years and during that time they have claimed to see significant departures from MCE during a number of unexpected events, such as the Turkish earthquake in 1999, and in anticipated events, such as the Year 2000 celebration. This paper examines the claim that the GCP EGG's responded to the September 11 attacks on New York and Washington.

Six major terrorist events that shook the world took place on 11 September 2001. Table 1 shows the timing and a brief description of each event taken from data at a seismic observatory at Palisades NY.[1]

Table 1. Timing and Details of the 11 September 2001 Events[2]

Date	Event Time (UTC)	Seismic Reception Time (EDT)	Remark
09/11/2001	12:46:26±1	08:46:26	First impact
09/11/2001	13:02:54±2	09:02:54	Second impact
09/11/2001	13:30:??	09:30:00	Pentagon impact
09/11/2001	13:59:04±1	09:59:04	First collapse
09/11/2001	14:28:31±1	10:28:31	Second collapse
09/11/2001	21:20:33±2	17:20:33	Building 7 collapse

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[1] http://www.ldeo.columbia.edu/LCSN/Eq/20010911_wtc.html.
[2] We have removed two columns and added one row to the original table for compactness and completeness. We took the timing of the Pentagon attack from http://abc.net.au/news/newsitems/s364516.htm.

The question we consider is this: Did the worldwide network of EGG's respond in some way to these large-scale, tragic events?

Analysis

There are a number of ways to examine the EGG data associated with the 11 September 2001 events, but we will take a "top down" approach. This includes testing the hypotheses posted on the GCP's web site as well as trying to confirm results posted in the 11 September Results Section on the site.

Database

Our database consisted of all the 31 days in August and all of the 30 days in September 2001. Each day consists of 86,400 seconds with the number of binary ones (i.e. hits) associated with each EGG for each second. For each second, we only included EGG's that were active (i.e., non-zero hits) and whose hits were in the range [50,150]. That is, if the number of hits were less than 50 or greater than 150, which correspond to a z-score of ± 7, we assumed that the EGG in question was faulty. For each second, we computed a Z and Z^2 for each egg, a Stouffer's Z across the valid EGG's and χ^2 as:

$$\chi^2 = \sum_{i=1}^{n} Z_i^2 \, , df = n.$$

where n is the number of valid EGG's. These two vectors were independently saved for August and September for later analysis.

First Order Look at the Data

For completeness, we have examined the Stouffer's Z data for all 86,400 seconds of 11 September 2001 in Eastern Daylight Time (EDT). For each Z, there is an associated p-value, which is the integral of the Normal distribution from Z to infinity. We computed the theoretical expectation for the p-values resulting from Z's in the range [-5.0, 5.0], and the observed values from the data of the p-value for each Z as:

$$P - Value = \frac{\# of\ Z's > Z_g}{Total\ \# of\ Z's},$$

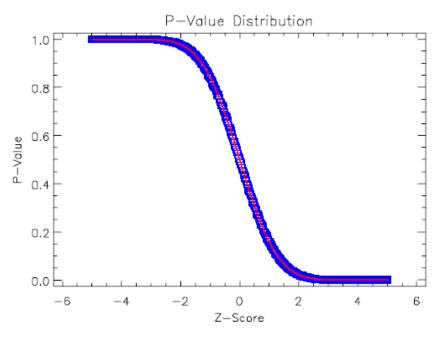where Z_g is the given value of Z. Figure 1 shows the result.

Figure 1. Distribution of P-Values for Stouffer's Z on 11 September 2001.

The wide curve (i.e., blue) represents the individual data points and the narrow curve (i.e., red) is the theoretical expectation. Figure 2 expands Figure 1 for Z's in [3, 5] region.
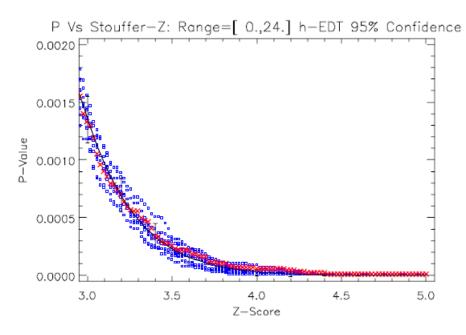

Figure 2. High-Z End of the P-Value Distribution.

In Figure 2, the open boxes (i.e., blue) represent the data from 10 random days chosen from the month of August, the x's (i.e. red) represent the data from 11 September 2001, and the smooth curve (i.e., black) represents the theoretical expectation and associated 95% confidence intervals-located at every 0.2 value of z-score beginning at z = 3.0.

For this day, the mean Z and standard deviation computed across all 86,400 Stouffer's Z's across EGG's is -0.00263 and 1.0025, respectively, and the grand Stouffer's Z across all seconds is -0.772. The expected values for these quantities are 0.0, 1.0, and 0.0, respectively.

Table 2. Distribution of Rare Z-Scores.

Z	Number of Z's or Greater			
	Observed			Expected
	August	September	Total	
4	90	87	177	167 ± 13
4.5	9	10	19	18 ± 4
5	1	1	2	2 ± 1

We conclude that the Stouffer's Z's for each second of 11 September were as expected by chance, and that even high values of some selected Z-scores were indistinguishable between the months of August (i.e., a putative control month) and September and indistinguishable from mean chance expectation.

The above analyses were for the Stouffer's Z combination across EGG's; however, we see similar curves to Figures 1 & 2 when we compute a Z from the χ2 resulting from the sum of Z^2 across all generators.

In parapsychological experiments on the effect of human intention on random number generators, the average effect size for a trial of 200 bits is about 0.003 (May et al., 1995). The GCP was conceived as a large-scale version of such laboratory experiments and an effect size comparable to that quoted might be expected for its results as well. However, we would not expect to see any small statistical changes by the above analyses. We presented this overview, however, to show that the design and engineering of the GCP's collection of EGG's was successful in that they generate well-behaved random numbers. To determine if these EGG's were altered by the events of 11 September requires further analyses.

11 September 2001: Hypothesis Testing

It is to be expected that in the early days of the GCP the primary effort was devoted to hypothesis formulation. After all, this was the first time something of this kind had been attempted and given the results of the laboratory based RNG studies, it was a reasonable expectation the a worldwide network of generators might be affected in some way by human affairs.

But in 2001, the hypothesis situation remains murky. On the one hand, for example, we quote from page 257 of Nelson (2001):[3]

The 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.

Each egg-site records data as "trials" at one per second, summing 200 bits for one trial. The 200-bit have expected mean = 100 and standard deviation = 7.071.

The mean deviation from expectation for a single trial across all EGG's, or the mean of a block of trials across EGG's, is normalized as a z-score.

The z-score is squared, yielding a χ2-distributed quantity with 1 degree of freedom representing a single trial or block of time specified in the prediction.

Because χ2 are additive, we may sum across EGG's and blocks of time.

The total χ2 represents the deviation for the predicted period of time. It has degrees of freedom equal to the number of segment z-scores.

This is compared with the appropriate χ2 distribution to yield a chance probability.

For example, let us focus on a 1-second tick of data from 36 EGG's. Item 3 above suggests that a grand z-score is computed across all EGG's for this second or equivalently a Stouffer's Z is computed from the individual z-scores from each individual EGG. Then this z-scored is squared to produce a χ2-distributed quantity with 1 degree of freedom.

Yet on the other hand, the GCP web site under Analysis->Statistics something else is suggested. We quote from the site (on 16 October 2001).

> The focus for most analyses will be anomalous shifts of the segment mean. As noted, the standard test for deviations from expected variation will be a <u>Chisquare comparison</u> of the composite deviation across all EGG's during the specified event against chance expectation. This composite will be a sum of the squared Z-scores for all EGG's and all predefined segments (e.g., seconds or 15-minute blocks). We will make exploratory assessments of other parameters, such as intercorrelation of the EGG's during an event, as possible indicators. Correspondence of computed deviations with the time-line of predictions will provide the primary criteria for statistical evaluation.

Navigating to the Chisquare comparison yields from items 6 and 7:

6. This χ^2 is computed for each Egg, and for each block of time specified in the prediction.

7. Since χ^2 are additive, we may sum across EGG's and across blocks of time.

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[3] We provided this paper in advance to Dr. Roger Nelson and he acknowledged through personal communication a contradiction in the stated protocols. We believe he may have corrected this unintentional oversight on the site by the public release of this document. Nonetheless, this change does not reflect the major difficulties the authors have with the conclusions still posted on the GCP web site.

This discussion seems quite clear that we should square each EGG z-score in place and then sum across EGG's.

So it is particularly problematic for an independent researcher to understand what exactly is the primary hypothesis. From our point of view, it seems squaring in place captures the 2-tailed nature of PSI-mediated RNG deviations; whereas, squaring the Stouffer's Z across EGG's appears too restrictive.

So to assess any possible 11 September 2001 effects on the worldwide network of EGG's we are obligated to examine both approaches.

Two χ^2 Analyses

For each event under study, researchers are invited to enter their predictions in the appropriate section on the GCP web site. We quote from the site with regard to the 11 September 2001 events:

> Prediction, Roger Nelson: (Written on Sept 12, after some preliminary examination of the data recorded on this frightening day. I was distracted but quite clear that this was formally a GCP event, and my prediction was not based on the early analysis.)

> On September 11, 2001, beginning at about 8:45 in the morning, a series of terrorist attacks destroyed the twin towers of the World Trade Center 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 second tower. At about 9:40, a third airliner crashed into the Pentagon. At about 9:58, the South tower collapsed, followed by the North tower at 10:28.

> The formal prediction for this event was not registered before any analysis, but because it is formulated on the basis established for the terrorist bombing in Africa in August 1998, there is no possibility of data selection based on prior examination of the data. The 1998 prediction specified a period "beginning a few minutes before the bombing, and including an aftermath of a few hours." The actual time was from 10 minutes before the bombing to three hours after. In this case we will specify 10 minutes before the first crash to four hours after, which makes the aftermath following the last of the major events, the collapse of the second tower, about the same as the period in 1998. The confidence level is high, and the resolution is seconds.

X^2 of the Stouffer's Z Across All EGG's

We are in agreement with Nelson's χ2analysis resulting from the Stouffer's Z across all EGG's. Figure 3 shows our results:
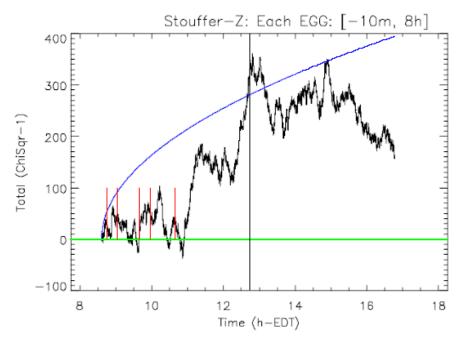

Figure 3. χ^{2}Analysis Resulting from the Stouffer's Z Across all EGG's.

We have computed the sums on a second-by-second basis. The vertical lines ending at 100 (red) represent event markers for the New York attacks and the vertical line at approximately 12:45 (black) represent the 4-hour cutoff described by Nelson in the prediction registry. The quasi-parabolic curve (blue) represents the p=0.05 significance envelope.

Technically, the null hypothesis must be rejected at the confidence level of 0.05. In the results section of the GCP site, the exact probability value obtained at this 4-hour cutoff is shown as p = 0.035.

X^2 of Each EGG and Summed Across EGG's

The computation we present here arose because of the conflicting methods from the publication (Nelson, 2001) and what was posted on the GCP web site at the time of this analysis. Even though the site has changed to correct this ambiguity, we leave it here because at the time it was appropriate, and in addition, in the authors' opinion this particular analysis (i.e., a two-tailed approach) makes more sense given their understanding of the GCP's conceptual framework.

Figure 4. shows the results of an accumulation of χ^2 based on a χ^2 computed from squaring the z-score on an individual EGG and summing across all valid EGG's for each second tick. This differs from the analysis shown in Figure 3 above in that a Stouffer's Z is computed across EGG's and then squared.
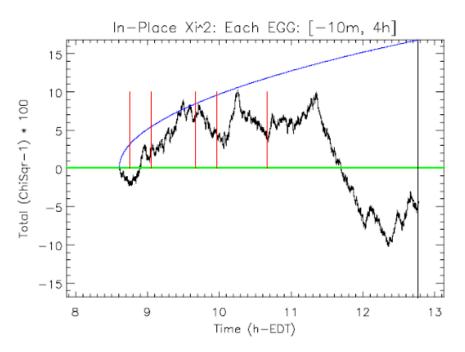
In-Place Xi^2: Each EGG: [-10m, 4h]

Figure 4. χ²Analysis Resulting from χ² Summed Across all EGG's

As before the short vertical lines (red) represent the New York attacks and the vertical line at about 12.75 (black) represents the four-hour window suggested by Nelson in the prediction registry. From this point of view there was no statistical meaningful evidence that the EGG network responded to the 11 September 2001 events.

Conclusion of χ² Analyses

Leaving aside the fact that Nelson's preliminary look at the data prior to analyses could have introduced an inadvertent bias in his choice of analyses parameters, we still remain unconvinced that the single alternative GCP hypothesis is true for the following reasons:

- We find the choice of a 4-hour analysis region fortuitous and lucky indeed. A case could be made from the prediction registry quoted above that the analysis window should have been the same as in the analysis of 1998 Africa bombing, namely either three hours after the first event or three hours after the last New York City attack. In both these cases, Figure 3 above shows that the test hypotheses would have failed to meet significance. In fact, any choice of analysis window except for an approximate half hour beginning at four hours after the first attack would also have failed. By Monte Carlo analysis, we have determined that the probability of the χ2 summation curve exiting prior to the end of a predetermined analysis period ranges between 0.475 and 0.500 depending upon the length of the interval. Thus, there is an approximate 50% chance of exiting the 0.05 significance envelope somewhere in the interval.

- Clearly the September attacks are as large in their impact and probably larger than the others that have been analyzed according to the GCP concept. It seems to us that they should have posted as large a significance level as these others and perhaps, given its impact, the largest deviation. Questioning the meaning of p = 0.05 or just above or below clouds the important question. That is, did the

network EGG's respond to the single largest catastrophe in American history? We remain unconvinced.

- Following the procedure from the Analysis->Statistics section of the site, which squares each EGG's z-core in place and combines the values across EGG's at each second,[4] we find that the accumulation of χ2 does not approach significance in the 4-hour summation window.

Radin's *post hoc* Findings

We identify Radin's analyses as shown in the results section on the GCP's web site as *post hoc* in that there was no entry in the prediction registry for these particular analyses.

Odds Based on Stouffer's Z

Figure 5 is similar to the plot shown in the results section on the GCP site. That is we confirm the spike of z = 4.81 for 1 second resolution at 10:12:47 EDT.
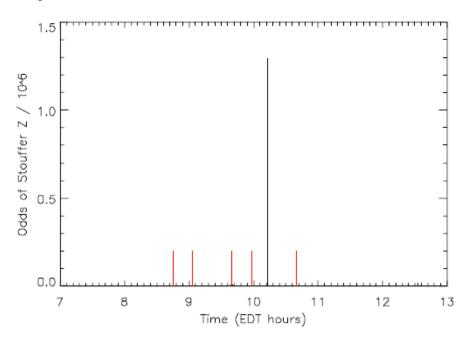

Figure 5. Linear Plot of Odd Associated with Summed χ^2 for Each Egg

The p-value associated with a z = 4.81 is 7.75 ×10-7 leading to the odds shown above of 1.29 ×10^6 to one. The fact that there is a z = 4.81 is not particularly surprising, but perhaps that it so happened in the middle of the chaotic events might be. The mean number of days between events of z = 4.81 is given by:

$$days = \frac{1}{84,400\,p} = \frac{1}{86,400 \times 7.7486 \times 10^{-7}} = 14.9.$$

This indicates that we expect, on the average 1 event of this magnitude or larger each 15 days, or in other terms there is a 1/15 probability of seeing such an event ±12 hours of

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[4] The posting we quote above was on the site, but at the time of the public release of the White Paper, the procedural ambiguity had been removed.

any specific time. Thus, while intriguing in its synchronicity, it is not particularly interesting to find this spike of odds in the middle of the chaos.

Linear plots with such large odds can be misleading in their graphical representation. Therefore we show the same graph in Figure 5 as a logarithm plot in Figure 6.
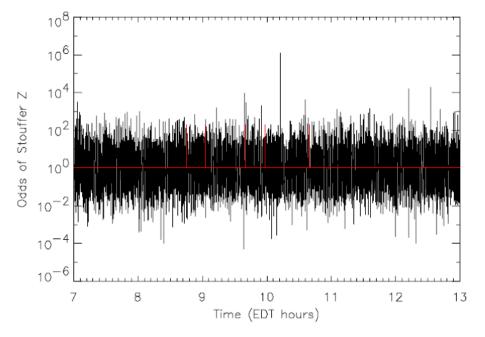

Figure 6. Log Plot of the Odds for the Data in Figure 5.

6-Hour Summation Window

Radin's odds plot for the day of 11 September 2001 is actually the result of a 6-hour summation.[5] That is, beginning say at 8:45:00 EDT the result for that second is computed as follows based upon the summed Z^2 for across EGG's for each second.

1. Sum χ^2 back in time for 6 hours = 21,600 seconds. The degrees of freedom is the sum over the same period of the number of active EGG's for each second.

2. Compute a Z-score as: $z = \sqrt{2\chi^2} - \sqrt{2df - 1}$.

3. Compute a p-value from this Z.

4. 4.   Compute odds as: $odds = (1 - p)/p$.

To compute the odds for the next second (i.e., 8:45:01) repeat steps 1-4 above. Figure 7 shows our replication of Radin's posted result.
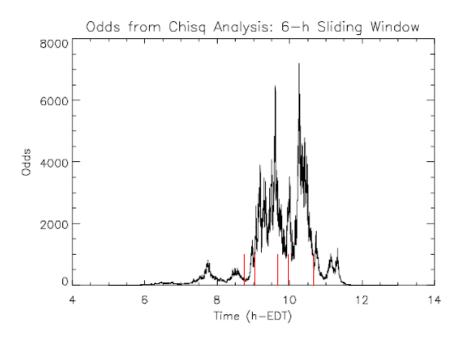
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[5] Private communication.

Figure 7. Replication of Radin's Result for 11 September 2001.

At first look this result appears to suggest that there was a rather significant effect upon the worldwide EGG network during the time of the terrible events on that day. Closer examination, however, reveals a different outcome. Henceforth we move to a logarithmic plot of the odds.

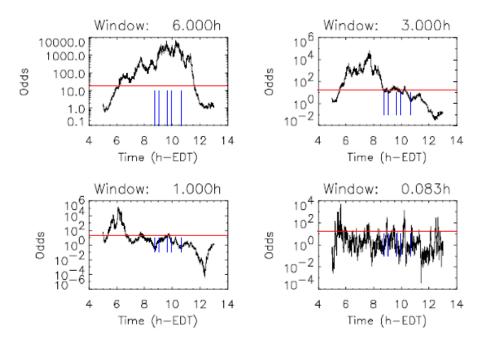Figure 8 shows the odds plot as a function of summation window width.

Figure 8. Odds as a Function of Summation Window Width.

The horizontal line (red) in each plot represents odds of 19:1 (i.e., p = 0.05) and the short vertical lines (blue) indicated the attacks in New York. A clue can be seen in the 6-hour plot. There is a sharp drop in the odds near 11:30, which indicates that the odds plot in the region of interest is dependent upon a much earlier deviation. For example, summing backward for 3 hours reduces the odds in the region of interest to near chance, which shows that the odds prior to the events contribute to inflating the odds computed with a 6-window during the events. The 1-hour plot is at chance except, perhaps, for some peaks between 5:00 and 6:30. The last plot is for a 5-minute summation window, and shows chance throughout.

Another way of demonstrating that there is no effect in the region of interest is to force the early χ^2s to chance by setting them equal to their degrees of freedom. Figure 9 shows the results of this test.
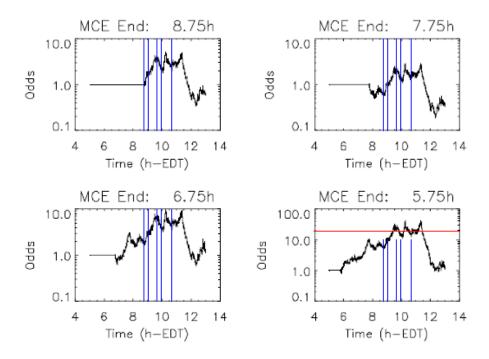

Figure 9. Setting Early Data to Chance.

Each plot is computed from a 6-hour summation window with the data from the beginning of the day (i.e., 0:00:00) up to the time shown set at chance. As the last plot suggests, the result shown as an odds plot in Figure 7 above and is posted on the GCP web site is entirely due to an anomaly prior to about 5:45—a full three hours before anyone, except for the group responsible, knew of the impending disaster. As the 1-hour result shown in Figure 8 suggest, there is no significant action during the time of the events when much of the world was riveted to CNN.

To confirm this result, we computed sliding windows for the data on 11 September 2001 and 10 randomly chosen days in August. Figure 10 shows the results for a 1-hour summation window.
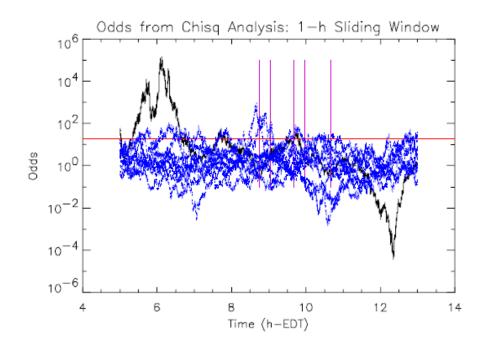
Figure 10. Odds for 1-h Window for 9/11/01 and 10 Random Days in August.

The dark curve (black) with odds maximum near 06:00 and minimum near 12:30 are the sum of χ^2s for a 1-hour sliding window for 11 September 2001. The lighter (blue) curves are the same summation for 10 random days selected from the August data. We notice that the 11 September data are at chance from about 07:00 to 13:00. While the sharp peaks at 6 and at 12:30 might draw attention, they are consistent with the chance result as shown, for example by the August peaks near 1000:1 odds around 8:30 and the August peaks at 7 and 10:30. A post hoc computation of determining the odds of such a separation is simply not valid.

Conclusion and Discussion

We have examined in detail the primary results with regard to the 11 September 2001 events as posted on the Global Consciousness Project web site and find that they do not hold up under close inspection. Leaving aside the administrative and organizational ambiguity with regard to how to compute the summation graphs, we did confirm Nelson's posting of an excursion just through the p = 0.05 envelope at four hours after the first event. Additionally, the accumulation of χ^2 based on Stouffer's Z remains above that level for only approximately 30 minutes out of the rest of the day of confusion, sorrow, and fear-worldwide. The computation of accumulation of χ^2 based upon sums of Z^2 across EGG's for each second was at chance at the end of the critical period.

We now address Radin's post hoc observations. Although there is a single 1-second Stouffer's Z of 4.81 in the middle of the New York attacks, we find that it is completely consistent with chance expectation and the distribution of z-scores. Furthermore, it has never been the claim that the EGG network would "feel our pain" for just a second and move on.

The 6-hour sliding window of odds resulting from sum of χ^2 based upon sums of Z^2 across EGG's for each second and its associated graph shown above in Figure 7 is problematic. The apparently impressive result in the critical region is not due to what was happening to the worldwide EGG network during the New York attacks, but arises completely from a statistical variation around 5:30 in the morning three hours prior to the attacks. Given the nature of random noise, and the "large" odds excursions from the random days in August, even the 5:30 peak is consistent with chance fluctuations.

Therefore we conclude that the EGG network did not significantly respond to the single largest, emotional, fearful, and well-publicized event in US history.

Radin's a priori choice of a 6-hour sliding window we now see was most fortuitous. Had it been 3-hours the odds graph would have looked considerably different and not persuasive at all. (See the 3-hour window plot in Figure 8.)

Similarly Nelson's choice of a 4-hour summation window was equally fortuitous. Had the choice been three hours after the fist event as the Embassy bombing case might suggest, or 3-hours after the last New York City attack, which could be considered consistent with the Embassy bombing as well, the formal null hypotheses would not have been rejected at the $p = 0.05$ level.

In attempting to understand these "lucky" choices one possibility is that analysts may use their PSI to construct computations to achieve a significant outcome from within an otherwise completely random system. To what extent such a hypothetical selection mechanism might have operated in this case is impossible to determine post hoc.

In the future as new events gain the attention of the GCP community, we urge that researchers:

- Data mine and formulate hypothesis based upon a randomly chosen subset of half of the EGG's.
- Test those formulated hypotheses with the remaining half of the EGG's.
- Note that it is not good policy to publish easily identified *post hoc* observations even if they are clearly labeled as such. For example: (From the GCP web site.)

  "This graph shows results for a 6-hour sliding window, in terms of z scores, from Sept 6 - 13. In this graph, positive z's mean the RNGs became "more ordered" than expected by chance. Negative z's mean the RNGs became "more random" than expected by chance. The peak value in this graph is 9:10 AM, Sept 11. Between the beginning of the tragedy and 7 hours later this data shows a drop of 6.5 sigma (odds against chance of 29 billion to 1). Such large changes will eventually occur by chance, of course, but this particular change happened during an unprecedented event, suggesting that this "spike" and "rebound" were not coincidental."

  Indeed a permutation analysis shows that the likelihood of getting a 6.5 sigma drop in Z-scores (based on a 6-hour sliding window) in one day, and within 8 hours of less (as observed) is $p = 0.002$"[6]

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[6] Italics from the original.

Not only is it easy, post hoc, to locate such fluctuations, random data require that they must exist somewhere. Additionally, to the general reader such statements are quite misleading.

Finally, it is tempting to data-mine this case and begin asking post hoc questions whether the day statistics are deviant in some way or whether the month of September, 2001 is somehow special, and so on. All such explorations could possibly achieve is to formulate new hypotheses which remain to be tested. They cannot of themselves be evidential.

The fact remains that if our analyses and interpretations of the data are correct, then it is our view that the worldwide network of EGG's did not respond to the terrible events of September 11, 2001.

References

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Nelson, R. (2001). Correlation of Global Events with REG Data: An Internet-Based, Nonlocal Anomalies Experiment. Journal of Parapsychology, 65, 3, 247-271.