A Disturbance in the Force:
Exploring Collective Consciousness at Burning Man

A Report on Five Years of Exploratory Experiments

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Photo courtesy of Sidney Erthal

Abstract

Experiments conducted by researchers from the Institute of Noetic Sciences from 2012 through 2016 at the Burning Man festival in Nevada's Black Rock Desert explored a subjective experience often reported by participants during the two main ceremonies – the Man Burn and the Temple Burn.

This subjective experience is variously described as an "energetic shift" or as "electricity in the air," and it seems to be evoked when tens of thousands of people coherently focus on the same event.

The experiments involved monitoring the outputs of truly random number generators (RNG) before, during, and after these ceremonies. The combined results of the five experiments, involving different numbers and types of RNGs, indicated a non-chance increase of order in the RNG outputs during the two main events.

This suggests that the *Star Wars* idea of a "disturbance in the Force" is more than a metaphor. It appears that moments of collective coherent attention are associated with an unexpected appearance of order in random physical systems. This in turn suggests the presence of a fundamental relationship between consciousness and the physical world.

INTRODUCTION

> *"The energy of the crowd is insane. Twenty thousand people. It's the biggest jolt of adrenaline. It's very hard to explain. You know the old story about the woman lifting the car off her kid? It's in that realm. You can actually hurt yourself and not know it."*
>
> *– Tom Petty*

Schools of fish, flocks of birds, termite mounds, and synchronous firefly flashing are striking examples of collective animal behavior. Similar forms of group behavior also occur in humans. Crowd psychology studies the behavior of vigilante mobs, stampedes, consumer fads, stock market booms and busts, and political movements. Such collective behaviors can be highly contagious and influence otherwise rational individuals into participating in destructive violence, adopting collective delusions, or generating remarkable examples of group altruism. Theories of crowd behavior note that as social animals, we are exquisitely sensitive to the herd instinct and are hardwired to imitate.

Here we consider a subtler form of the effect of collective consciousness. An artistic portrayal of this phenomenon was depicted in a key scene in the movie *Star Wars.* The Jedi Knight, Obi-Wan Kenobe, while traveling in a spaceship, suddenly staggered and said, "I felt a great disturbance in the Force, as if millions of voices suddenly cried out in terror and were suddenly silenced." He said this just as a weapon was being deployed to destroy an entire planet. The Force was described by Obi-Wan as "an energy field created by all living things. It surrounds us and penetrates us; it binds the galaxy together."

Obi-Wan Kenobe, sensing a disturbance in the Force.

The question posed in the present study is whether this artistic impression of a living Force, which is described in one form or another in all of the world's esoteric traditions, is just a mythical fiction or if it is a measurably real phenomenon. Our approach was based on the observation that during participation in group sports, music, or dance, many people occasionally report palpable, expansive feelings associated with the experience of merging into the group's collective mind. Such moments are described as an "energetic shift," or elaborated with phrases like a feeling of "electricity in the air," "being in the zone," or "going with the flow." The term *energy* in this context is not what a physicist means when discussing the four known forces, but rather what people describe as subjective sensations of unusual vibrancy, excitement, or aliveness.

This phenomenon may be analogous to the resonance experienced by a group of metronomes placed on a flexible surface and running at similar – but not exactly the same – frequencies. Such an arrangement allows the metronomes to shift from a state of maximum entropy (randomness), where each metronome acts independently to form a cacophony of random ticking sounds, into a state of maximum negentropy (order) where their separate movements become bound together and synchronized, forming a single, uniform clock tick. From the perspective of each metronome, the transition from acting independently to becoming part of the collective might be experienced (in an anthropometric sense) as a release of personal effort and a subsequent rise in "energy," because it is metaphorically easier to swim with the current than against it.

Psyleron random number generator, attached to a laptop PC.

Previous studies investigating this energetic shift effect, dubbed "field consciousness" experiments, have examined shifts in entropy during periods of high collective attention in relationship to the behavior of physical devices known as electronic random number generators (RNG). The RNGs used in such studies are designed to do three things: (1) generate maximum entropy in the form of streams of truly random bits, (2) where those bit streams pass well-accepted statistical tests for randomness, and (3) the device rigorously excludes environmental influences such as fluctuations in electromagnetic fields, ambient temperature, humidity, vibration, etc. The term "truly random" indicates that the source of randomness is physical and completely unpredictable, as opposed to deterministic pseudorandom sequences generated by computer software.

If, during periods of high collective attention, RNG outputs are found to generate random bit sequences that are less random than expected by chance, and during control periods when attention is scattered the RNG outputs are in accordance with chance expectation, then those observations may be used as evidence that reports of energetic shifts involve more than mundane psychological or physiological effects.

The five field consciousness experiments described here explored the nature of this shift during two major ceremonies at the annual Burning Man festival. Each event attracts the rapt attention of tens of thousands of attendees. The first is the *Man Burn*, a ceremonial burning of a large wooden statue of a man. It takes place on a Saturday night at 9 PM, the second to last day of the week-long festival. The second event is the *Temple Burn*, an ornate wooden temple where remembrances of loved ones are placed and then ceremonially burned. This takes place on a Sunday at 8 PM, the last day of the festival. The former ritual is typically celebratory and wild; the latter is solemn and contemplative.

Burning Man was selected as the venue for these experiments because (a) the festival attracts tens of thousands of people, (b) it takes place in a thoroughly isolated desert environment, far from the nearest electrical power grid, (c) it takes significant travel, preparation and financial planning to attend the festival, so the participants are highly motivated, and (d) attendees have often mentioned that the Man and Temple burns, which take place near the end of the festival, regularly evoke the types of subjective shifts that are of interest in these experiments.

Field consciousness experiments were initiated by Dr. Roger Nelson at Princeton University in the mid-1990s. Approximately 100 studies were explored by Nelson and others (see Bibliography), including at venues such as theatrical plays, movies, sacred sites, meditation groups, choruses, and other events that tend to attract and coalesce group interest. The single largest experiment of this type is the ongoing open-access Global Consciousness Project (GCP, http://global-mind.org/), begun by Nelson in 1998. At its peak the GCP consisted of about 70 RNGs located in major cities around the world, all actively collecting random data 24/7. By January 2016 the GCP had studied 500 formally defined, worldwide events, and the overall deviation from chance was greater than 7 sigma (standard errors), indicating that on average the RNGs were behaving less randomly than expected by chance, with odds against chance of over a trillion to one.

That outcome, combined with the results of previously successful studies, suggests that it is no longer necessary to conduct experiments that are solely proof-oriented. Instead, it is more fruitful to focus on improving methods of detecting these effects, devising explanatory models of the underlying mechanisms, and understanding what is happening within the RNGs that lead to the observed deviations. As such, all of the experiments described here were explicitly exploratory, designed to probe the nature of field consciousness effects in new ways.

Experiment 2012

METHOD

In this study we used a Psyleron RNG (Psyleron model REG-1, Princeton New Jersey) to collect 800 random bits per second from Wednesday night August 29th, 2012 through Monday morning, September 3rd, 2012. This RNG was designed to decouple the generated random bits from environmental influences. This was accomplished by use of an exclusive-or (XOR) logic gate applied to the "raw" random bits generated within the circuit.

An XOR gate compares a sequence of generated random bits against an alternating sequence of 0s and 1s (typically). It outputs a 0 if each pair of bits differ and a 1 if the bits are the same. In this way if the RNG hardware fails and begins to generate just a string of 0s, or if the source of randomness is influenced by some factor in the environment (like variations in temperature), then the output of the RNG will move toward the chance-expected average value of 50% 0s and 50% 1s, rather than an average of 100% 0s and 0% 1s. This design feature is important because it ensures that deviations away from chance (either mean or variance shifts) cannot be attributed to mundane reasons.

To compute deviations from randomness, we formed

1) a standard normal deviate (i.e., a *z* score) from each second of binary data, as $z = (x - .5)/\sqrt{pq/N}$, where *x* was the average of *N* = 800 bits per second, *p* = 0.5 and *q* = 1 - *p*;
2) a sliding window of z scores from step 1, one hour in width; and
3) z-score normalization of the curve resulting in step 2.

After creating this curve, the question of interest was as follows: What is the joint probability of obtaining the observed maximum deviation from chance (call this p_1) within an hour of the beginning of the Man Burn ceremony (call this p_2). A field consciousness effect would predict that during this period the randomness generated by the RNG would undergo a negentropic shift (i.e., a movement toward order). That in turn would lead to a joint probability ($pj = p_1 \times p_2$) achieving a minimum, because just before the ceremony we inferred that people would be gathering in anticipation and during the ceremony itself they would be paying attention to the ongoing event.

A nonparametric bootstrap technique was used to evaluate the results, as follows: (1) determine the joint probability ($p_1 \times p_2$) for the original data, (2) randomly scramble the original per-second *z* scores (a prior autocorrelation test confirmed that the *z* scores were independent of each other); (3) using the scrambled z scores in step 2 recalculate the first two steps, (4) determine *pj* for the scrambled curve, (5) increment a counter if *pj* was less than the *pj* obtained using the original data, and then (6) repeat this process 5,000 times. The statistic of interest was this count divided by 5,000. The same analysis was used to study deviations during the Man Burn and the Temple Burn ceremonies.

RESULTS

The Psyleron RNG output was recorded by a laptop PC located in a recreational vehicle (RV) parked at the festival, about a half-mile from the burning man effigy. Gaps in data collection occasionally occurred due to power interruptions while the PC laptop's battery was recharged by the RV's electrical generator. A total of 286,488 samples were recorded, one sample per second.

Figure 1 shows that the maximum deviation from chance (associated with $z = 3.77$) occurred 8 minutes and 42 seconds before the beginning of the Man Burn ceremony. The joint probability of obtaining a peak value of that magnitude and as close in time to the ceremony was determined by the permutation method to be $pj = 0.003$. The same analysis applied to the Temple Burn was $pj = 0.346$.

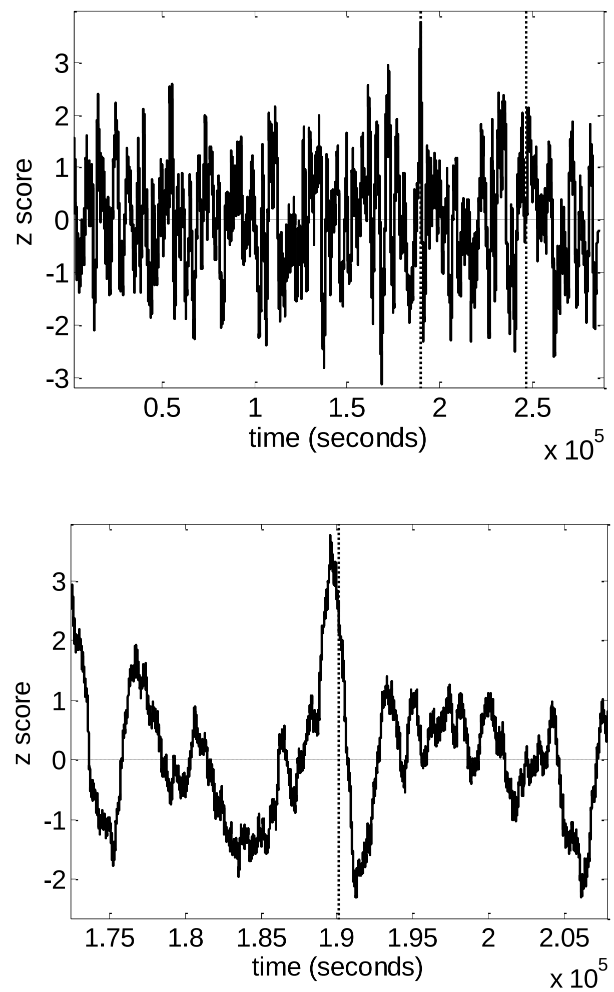


Figure 1. (*Top*) Per second z scores produced by the Psyleron RNG, smoothed in a one-hour sliding window. The first dotted vertical line (at 190,109 seconds) indicates the beginning of the Man Burn ceremony; the second vertical line indicates the beginning of the Temple Burn ceremony. (*Bottom*) Close-up of the *z* score at the beginning of the Man Burn.

Experiment 2013

METHOD

To see if the outcome of the 2012 experiment might have been due to an idiosyncratic quirk of the Psyerlon RNG, this experiment simultaneously collected data from six RNGs. One was a Psyleron; two were based on a similar device from an independent manufacturer (the Orion, Amsterdam, The Netherlands); two were based on latencies between emissions of alpha particles from a source of Thorium-232 (RM-60 Geiger Counter, Aware Electronics, Wilmington, DE),[1] and the sixth was based on the behavior of photons passing through or bouncing off a half-silvered mirror (Quantis, ID Quantique, Switzerland). The Psyleron, Orion and Quantis RNGs used XOR logic on the output to decouple the generator from environmental influences.

Data from the Quantis and the Psyleron RNGs were collected on a Panasonic Toughbook PC running Windows 7; data from the Orion and RM-60s were recorded on two General Dynamics Itronic PCs running Windows XP. The Toughbook and Itronic PCs were located approximately a mile from the Man effigy, and all of the PCs ran on batteries during recordings. Data were recorded for a minimum of one hour on all six devices the evening before, the evening of, and the evening after the Man and Temple Burn ceremonies. Because the PCs ran on batteries data were occasionally not available from all six RNGs.

To analyze the results, the following procedures were employed:

1) Calculate the mean z score for each second of data across the six RNGs,
2) form a one-hour sliding window curve from the data in Step 1,
3) normalize the curve produced in Step 2 with a *z*-score transform,
4) determine the probability p_1 for the maximum z score observed and the probability p_2 for the proximity of that maximum to the beginning of the ceremony, then create the joint probability $jp = p1 \times p2$,
5) randomly permute the original data, repeat steps 1-3, and if the resulting joint probability is smaller than the original *jp*, then increment a counter,
6) repeat step 5 a total of 5,000 times,
7) the final p value is p = counter /5000 .

RESULTS

Data were recorded on all six RNGs the night before, the night of, and the night after the two main ceremonies (August 30, 31, and September 1, 2013). The electronic RNGs recorded 200 bits/second and the Geiger Counter RNG recorded the number of alpha particle hits measured per second.

Figure 2 (left) shows that the mean z score across the six RNGs during the Man Burn ceremony peaked significantly above chance 2.4 minutes after the man began to burn, and that the mean *z* across four RNGs (Psyleron, Geiger Counter, Orion and Quantis) running during the Temple Burn (Figure 2, right) peaked 14 seconds before the beginning of the Temple Burn ceremony. Figure 3 shows the same analysis for five RNGs

[1] z-scores for the Geiger Counter-based RNGs were based on normalized counts of ionizing radiation detected per second.

(all but the Quantis) running at the same time of the evening as the Man Burn, but on a day when no major ceremonies were scheduled in the evening (August 30). Analysis showed that the joint probability for the Man Burn was *pj* = 0.036, for the Temple Burn *pj* = 0.006, and for August 30 *pj* = 0.358.

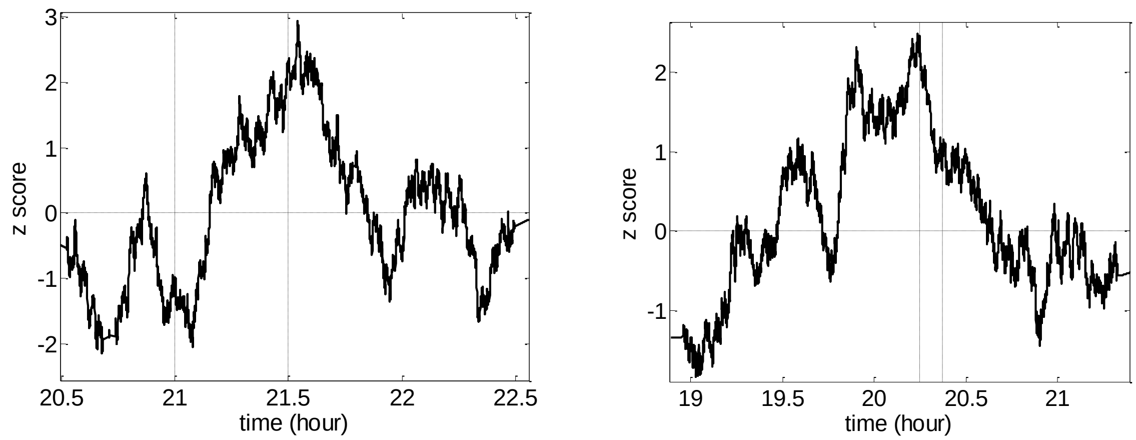


Figure 2. (Left) Mean z score across 6 RNGs during the Man Burn. The first vertical line shows the beginning of the ceremony; the second shows when the burn itself began. The peak deviation of $z = 2.74$ occurred 2.4 minutes after the burn began. The joint probability of this outcome was $p = 0.036$. (Right) Same analysis for 4 RNGs running during the Temple Burn. The peak deviation of $z = 2.25$ occurred 14 seconds before the Temple Burn ceremony began. The joint probability of this outcome was $p = 0.006$.

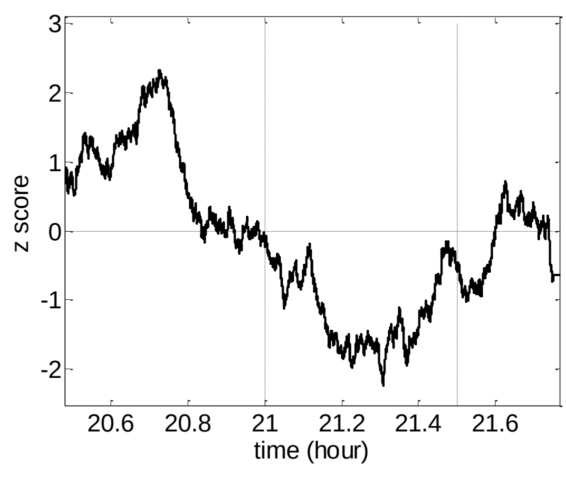


Figure 3. *z* score curve for control data recording on August 30, 2013. The vertical lines are at same times as the Man Burn ceremony. The joint probability of this outcome was $p = 0.358$.

Experiment 2014

The 2012 and 2013 experiments indicated that the source of randomness in the RNG was not a critical factor. However, any attempt to determine *why* the observed deviations occurred was obscured by use of the RNGs' XOR logic. To avoid this problem in our 2014 experiment we designed a new kind of RNG that recorded the random noise prior to its being converted into bits. The device we built used electron-tunneling noise generated by a Zener diode as the source of randomness, which is the same type of semiconductor component used in the Psyleron and Orion RNGs. The analog noise produced by the diode was amplified, digitized and stored at 44.1K Hz. We refer to this new electronic circuit as a Quantum Noise Generator (QNG). Figure 4 is a photo of two QNG circuits.

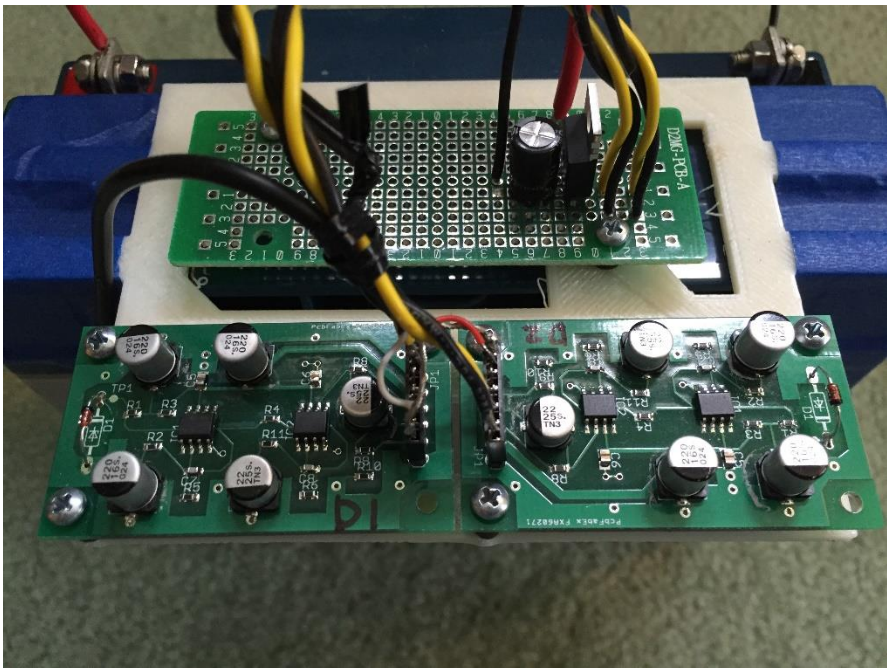


Figure 4 Two quantum noise generator (QNG) circuits attached to a battery. The random source was electron tunneling in a Zener diode.

METHOD

Our plan called for 20 QNGs to be deployed on the desert playa, placed as shown in Figure 5. To analyze the data produced by these devices, the following steps were taken:

1) Determine the mean of each second of data (recorded at 44,100 samples per second) from each QNG, where each QNG consisted of two independent data channels,
2) calculate the correlation between all possible pairs of per-second means spanning a 20-minute sliding window,[2] and then form the grand mean of those correlations (one such mean per second),

[2] A 20-minute sliding window was used, rather than the one-hour window as in the 2012 and 2013 experiments because the database in this case was only two hours long.

3) repeat steps 1-2 for all 7200 seconds across the two hours of data to form a curve with one-second resolution,
4) determine the joint probability of the (absolute) peak deviation in the curve formed in step 3 in proximity to the beginning of the Temple Burn;
5) randomly scramble the order of the original data,
6) repeat steps 1-4 using the scrambled data, ultimately forming a collection of 1,000 curves, incrementing a counter in each case when the scrambled joint probability is less than the original joint probability,
7) the final p value is p = counter/1000 .

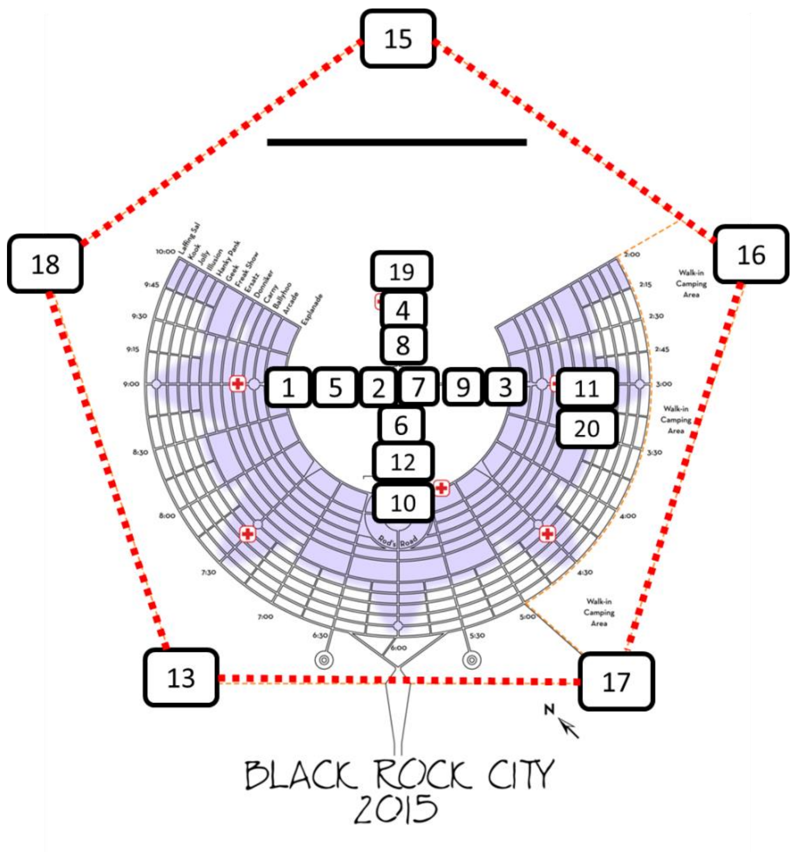


Figure 5. Planned location of QNGs on the playa. The black bar in the figure below QNG 15 is one mile in length. The Man Burn ceremony took place between QNG 2 and 7; the Temple Burn ceremony took place near QNG 19.

RESULTS

Because of challenges involved in conducting experiments with the new equipment, we were only able to install 5 QNGs, each of which had two random datastreams. This ultimately provided 10 datasets on Sunday evening, August 31, with two hours of reliable data spanning the Temple Burn. Each channel of data consisted of about 1 GByte of data. Due to technical problems with the QNGs it was not possible to obtain reliable data during the Saturday evening Man Burn, so no analysis was performed for that event.

Figure 6 shows the (normalized) mean cross-correlation curve for the Temple Burn. This result indicated that the outputs from the 10 datastreams exhibited significant dependencies during the period of interest. The joint probability of the observed (negative) peak, occurring in temporal proximity to the Temple Burn, was determined to be $p = 0.09$.

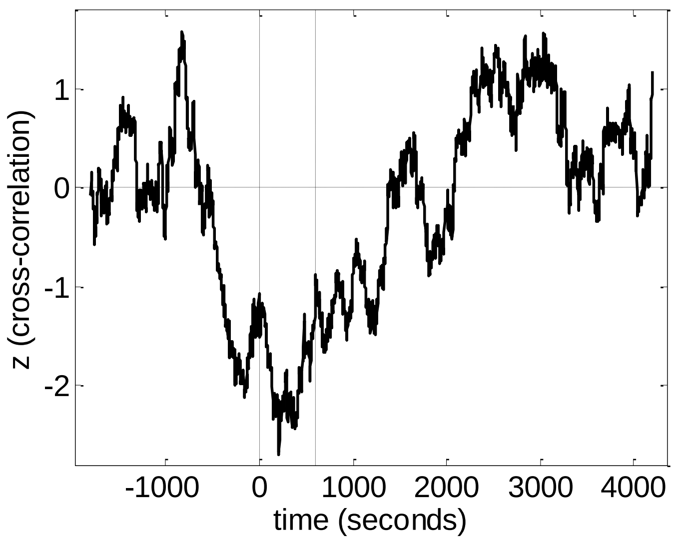


Figure 6. Mean cross-correlation across 10 random noise channels, determined second by second in a 20-minute sliding window, then normalized into *z* scores. The first vertical line at time 0 is the beginning of the Temple Burn ceremony; the second line indicates the end of the burn. The (absolute) maximum deviation of $z = 2.76$ occurred about half-way through the ceremony.

Experiment 2015

After reviewing the challenges faced by our plan to deploy 20 QNGs in 2014, we gained a more realistic idea about how to run the 2015 experiment. Revisions included use of solar panels to help charge the batteries and reduction of the noise sampling rate from 44.1K Hz to 32K Hz to reduce the required memory storage.

Method

The following steps were used to analyze the data:

1) For each of the planned 40 data streams each second of data (32K Hz) was downsampled by a factor of 160 to produce 200 noise samples per second,
2) the mean of each segment of 200 samples was formed to create 60 noise values per minute,
3) for each minute of data (60 values) the mean cross-correlation was formed across all pairs of datastreams generated by all of the QNGs during the same minute,
4) each minute's cross-correlation mean was normalized via a t-test used to compare the mean value against the chance-expected null; this step took into account the fact that the number of correlations contributing to the mean was not uniform across the entire data recording period,
5) a 3-hour sliding window (to help visualize the results in a single curve given that the dataset consisted of over 12,000 minutes of data) was formed,
6) the curve resulting from step 4 was evaluating using a randomized permutation technique, as previously described.

Results

A total of 2.6 TBytes of data were successfully recorded from 19 QNGs, for a peak of 38 simultaneously datastreams. The first sample was recorded on August 29, 2015 around 8 PM and the last on September 7, 2015 around 4 PM. As in the 2014 study, the QNGs were distributed around the playa. Some of the RNGs ran continuously for the 7 days of the festival while others ran for shorter periods. Figure 7 shows the number of QNG datastreams recorded over the course of the festival. The shorter runs occurred because it was overcast for three days during the festival and some of the solar panels were unable to keep all of the batteries sufficiently charged.

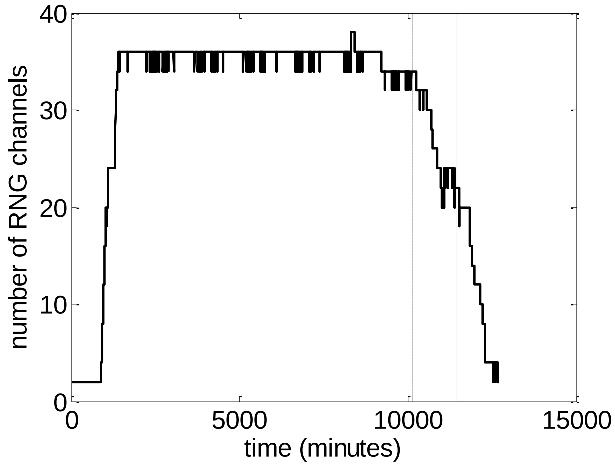


Figure 7. Number of datastreams recorded per minute over the course of the 7-day experiment, with each minute consisting of 60 groups of 200 samples each. The first vertical line is the start of the man burn, the second is the start of the temple burn.

Figure 8 shows examples of the random noise data recorded in four of the QNGs. These graphs are representative of the kinds of data produced by these devices. When all data across all QNGs were combined, diurnal effects linked to fluctuations in ambient temperature were clearly evident (Figure 9).

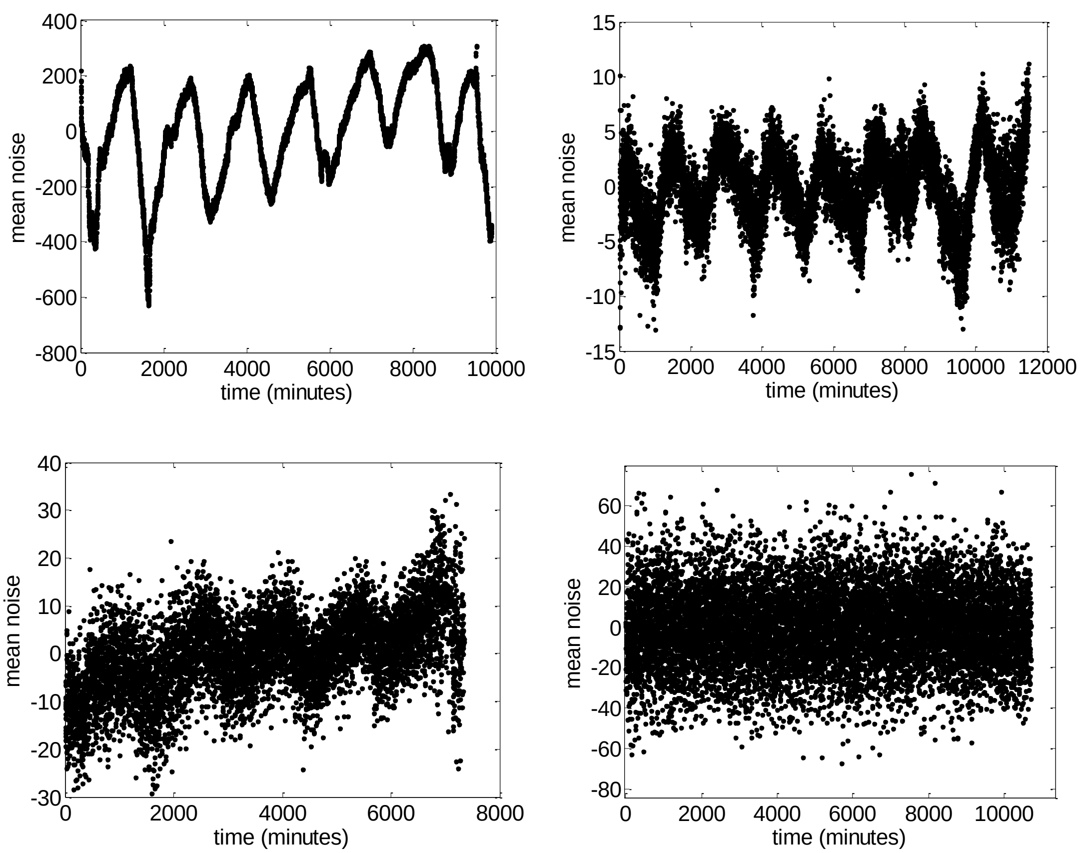


Figure 8. Mean noise data recorded over the course of the experiment. Some of the datastreams showed clear diurnal effects, others did not.

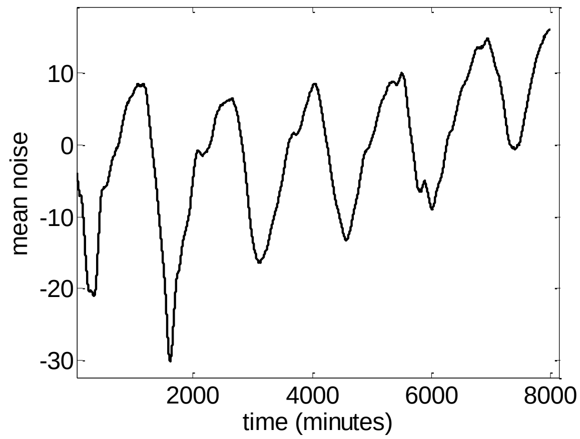


Figure 9. Smoothed mean of the datastream recorded across all QNGs. The peaks and troughs are a 24 hour pattern, indicating that components in the devices were sensitive to ambient temperature.

Because of the diurnal patterns observed in the noise levels, it was necessary to check how variations in temperature affected the cross-correlations, especially given that the two noise channels in each QNG were powered off the same battery. To do this we calculated the correlation between the two channels of noise generated by each QNG.

Figure 10 shows four of the resulting correlations; they are representative of the types of correlations observed in the QNGs. These analyses indicated (1) that as the QNGs started up it took about 1,000 minutes for the mean cross-correlation to settle down to near-zero, and (2) before they stopped recording (because the batteries ran down) the correlations began to show large variances. Unfortunately, the ending periods were most important in our analysis because the Man and Temple Burns took place at the end of the festival. The correlation variances were observed to radically deviate from the expected near-zero mean about 2 to 8 hours before the QNG stopped working. Thus, to exclude potential artifacts due to those variations, the final 12 hours of data produced by each QNG were excluded from all subsequent analyses. Of special note in this analysis was the correlation in QNG 18, shown at the lower right of Figure 10. We will return to that later.

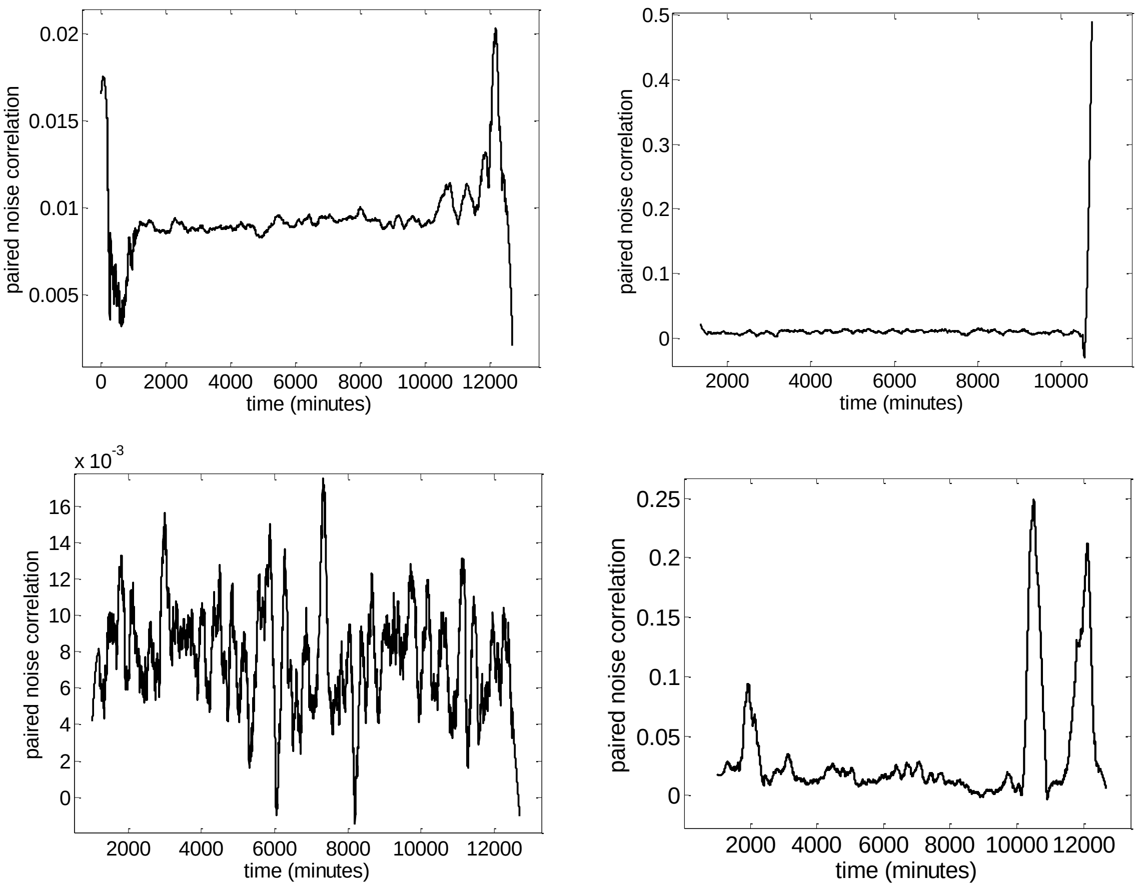


Figure 10. Examples of correlations between the two datastreams within four of the RNGs. These curves are representative of the types of correlations observed in all the RNGs. Note that the scales on this graphs are not the same.

After trimming the last 12 hours from each datastream, the mean cross-correlation analysis was calculated across all QNGs. The resulting values were quite stable from about minute 2,000 to 11,500, as shown in Figure 11.

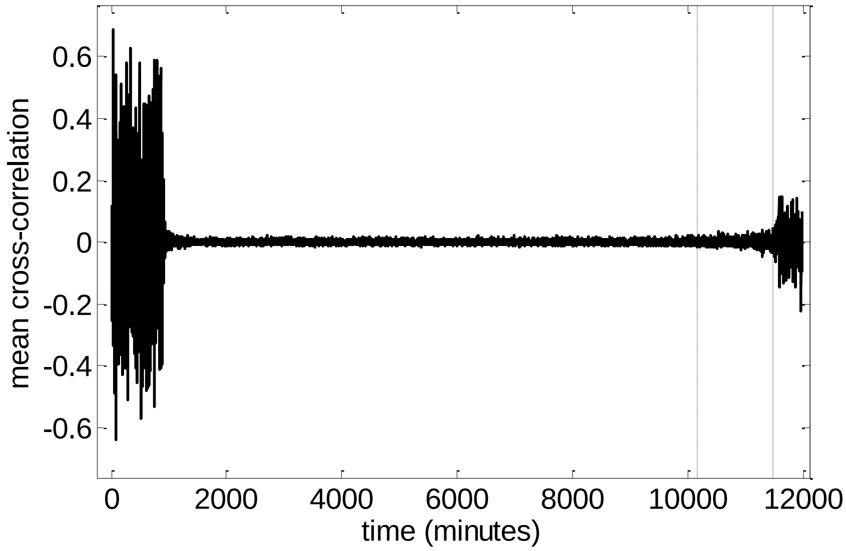


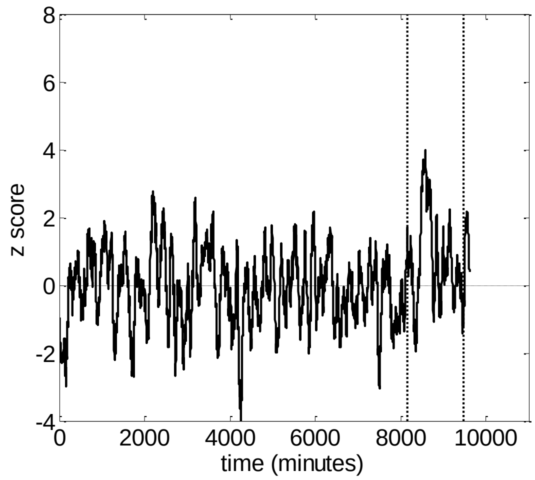
Figure 11. Mean cross-correlation across all RNGs, calculated per minute.

Using the trimmed QNG datasets, the 3-hour sliding window analysis mentioned in step 5 above was applied and the result, shown in Figure 12A, indicates a significant rise about 7 hours after the start of the Man Burn (z = 4.0), and another significant rise at the start of the temple burn (z = 2.1). Because these combined deviations looked similar to the large deviations observed in QNG 18 (Figure 10, lower right), to check if the combined outcome was due to an artifact in that RNG, the analysis was re-run excluding QNG 18. The curve shown in Figure 12B indicates that these deviations persisted and were not due to that QNG.

It is not clear that each QNG datastream would necessarily deviate from chance in the same direction, so the analysis was conducted again using the standard deviation of the noise rather than the mean. The result, shown in Figure 12C, indicates a statistically stronger effect, again peaking about 7 hours after the Man Burn (z = 7.0); a nonsignificant positive deviation was observed at the start of the Temple Burn (z = 1.0).

It is not known why the large cross-correlation deviation occurred 7 hours *after* the Man Burn, but from a statistical perspective that deviation is so large that it warrants further investigation. It's conceivable that this effect might have been due to movements of thousands of people and vehicles leaving the festival shortly after the close of the Man Burn ceremony. An argument against this "exodus hypothesis" is that the QNGs were distributed miles apart, and many of them were not near people or vehicles.

The joint probability of obtaining a peak value of the observed magnitude within 3 hours of the ceremony, and as close in time to the beginning of the Man Burn ceremony as observed, was *pj* = 0.128. The same analysis applied to the Temple Burn was *pj* = 0.585. For a one hour sliding window p(Man) = 0.428 p(Temple) = 0.647.



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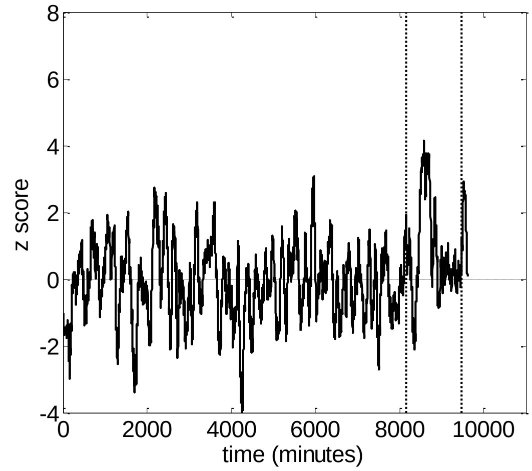

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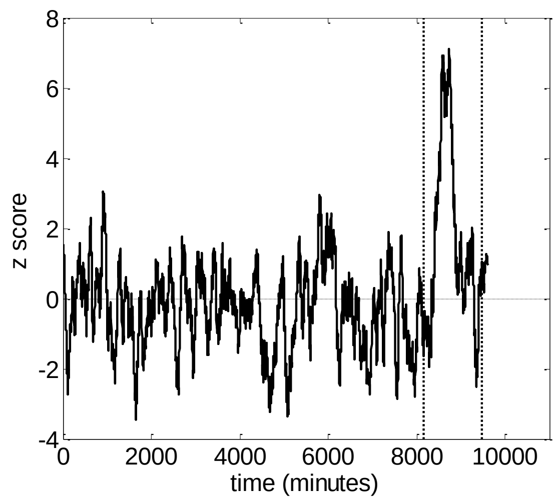


C

Figure 12. QNG normalized mean cross-correlations smoothed with a 3-hour sliding window and shown in terms of z scores. The first vertical line is the beginning of the Man Burn, the second is the beginning of the Temple Burn. (A) All RNGs. (B). The same except excluding RNG 18. (C). The same as A except based on the standard deviation of the noise rather than the mean of the noise.

Experiment 2016

In 2016 we again revised the QNG design to help ensure that we could record continuous data over the course of the festival. We also placed all of the QNGs inside an RV instead of attempting to place the devices out on the playa. Previous attempts using outdoor QNGs informed us that the desert environment is simply too harsh and unpredictable to reliably gain continuous data. In addition, we further miniaturized the QNGs and the sample rate was reduced to about 1K Hz. A total of 30 channels of data were successful collected continuously for 8 days, running on a battery.

In this study, we conducted two analyses designed to more directly explore the idea of a “disturbance in the Force,” imagined as a kind of warp in spacetime. One analysis examined average variations in a measure of autocorrelation between samples. This allowed us to detect a “temporal disturbance” in the Force. The other analysis examined changes in mutual information among the QNG outputs. This allowed us to measure a “spatial disturbance” in the Force.

METHOD

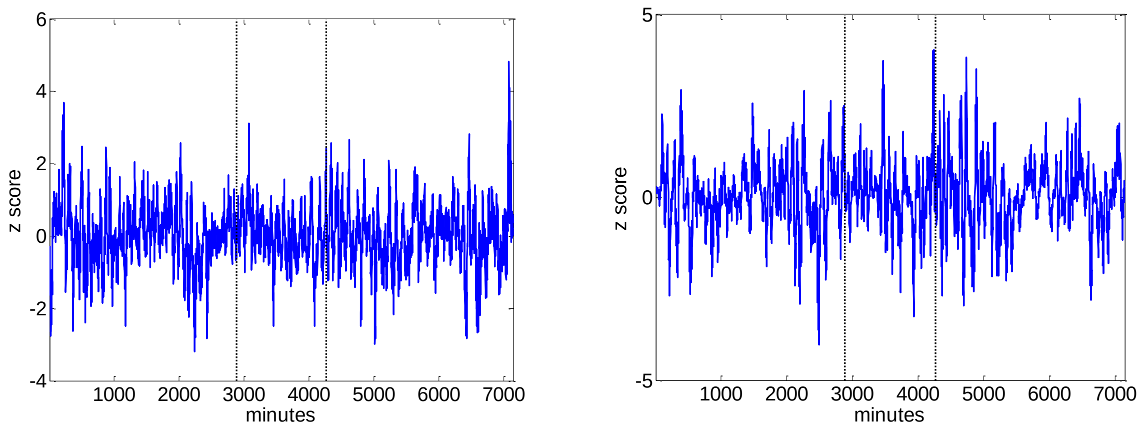
The following steps were used to analyze the data:

1) For each minute of data in each QNG the mean autocorrelation was found for lags 1 – 10.
2) The grand mean autocorrelation per minute was determined across all lags and all 30 QNGs.
3) The mean of a 60-minute sliding window was determined for two days of data prior to the Man Burn to 2 days after the Temple Burn. The sliding window was advanced minute by minute.
4) The resulting array was z-score normalized.
5) Maximum z scores were found within ±30 minutes of the Man Burn and the Temple Burn. These two z scores were combined into a single Stouffer Z score.
6) To evaluate the likelihood of that Stouffer Z score, the original array in Step 4 was circular shifted 1 to N times, where N was the length of the array. With each shift the same Stouffer Z score was determined as in step 5. All N Stouffer Zs were stored.
7) The final p value compared the probability associated with original Stouffer Z to the N shifted probabilities.
8) A similar 8-step process was conducted for the average mutual information calculated among the 30 datastreams, with one value per minute.
9) The final p values from steps 7 and 8 were converted into z scores with inverse normal transforms, then combined into a single Stouffer Z score. That Z score, and its associated probability, was the final assessment of a space-time disturbance in the force.

RESULTS

A total of 11,632 minutes (8 days) of continuous data were collected in each of 30 QNGs, starting August 31, 2016 at 10 AM and ending September 8, 2016 at noon. Figure 13 shows two days of data before the Man Burn to two days after the Temple Burn, for a mutual information analysis (Fig. 13 left) and an autocorrelation analysis (Fig. 13 right). The analysis found that for the mutual information analysis final p =

0.168 (largely due to a positive deviation that peaked at z = 2.51 one minute before the Temple Burn), and for the autocorrelation analysis p = 0.005 (largely due to a positive deviation that peaked at z = 4.6 some 29 minutes before the Temple Burn). The combined Stouffer Z score = 2.50, p = 0.006. Thus, this analysis showed some evidence of a space and time distortion within 30 minutes of both the Man Burn and the Temple Burn (but mostly the Temple Burn) over the course of 192 hours of data. When considering the autocorrelation analysis separately the Man Burn z = 1.412 and the Temple Burn z = 3.069, and for the mutual information analysis the Man Burn z = -0.235 and the Temple Burn z = 1.383. A Stouffer Z combining the two Man Burn z scores = 0.823 and the two Temple Burn z scores = 3.148.



Mutual information   Autocorrelation

Figure 13. Mutual information and autocorrelation analyses in 2016.

DISCUSSION

Table 1 summarizes the results of the five studies. Eight of 9 analyses produced positive results, three were independently statistically significant (two-tail), and when all results were combined the field consciousness hypothesis was supported for both the Man Burn (*z* = 3.25, *p* = 0.001, two-tail) and the Temple Burn events (*z* = 3.21, *p* = 0.001, two-tail). However, these results are only suggestive rather than definitive because the analytical methods across the different experiments varied and were not strictly pre-planned.

Table 1: Results of the five field consciousness experiments

Experiment	Window	z(Man)	z(Temple)
2012	1 hour	2.748	0.396
2013	1 hour	1.799	2.512
2014	20 min		1.341
2015	3 hours	1.136	-0.215
2016	1 hour	0.823	3.148

These results, especially when viewed in light of previous field consciousness experiments, suggest that collective coherence effects may be observed with different sources of randomness, including random bits conditioned through XOR logic, and pure electronic noise. This suggests that the underlying effect of collective consciousness may be better modeled as a “negentropic field” or coherence principle rather than any sort of conventional force-field. To further explore this idea, future experiments might wish to focus on the detection of coherence or generation of order in physical systems beyond RNGs and QNGs. One could predict, for example, that during periods of intense mental coherence one might observe say, improved battery efficiency, more efficient chemical reactions, more robust seed growth, and so on. In each case, regardless of the target system one could predict it to shift in a direction associated with greater coherence, however such coherence might manifest in that particular system.

LIMITATIONS

Because there are innumerable ways to analyze large datasets, to avoid data snooping future studies would ideally use the same pre-planned protocols and analyses. In the present experiments, we were able to employ similar joint probability analyses in the first four studies, but the same sliding window sizes could not be uniformly applied across all experiments because the available datasets were different lengths, they were recorded at different time scales, and the analyses tested different underlying ideas (e.g., deviation from chance expectation, mean cross-correlations, mean autocorrelations, and mean mutual information).

To formally test whether the sliding window sizes may have introduced spurious results, it is possible to re-run each analysis using a broad range of window sizes. But then the results would have to be adjusted for multiple analyses, and that would in turn make it progressively more difficult to detect a genuinely significant result. Thus, the most easily defensible analytical solution for a future experiment would be to pre-specify all of the analytical procedures.

Conducting these experiments at Burning Man offered a unique field-test of the collective consciousness hypothesis. We also learned that the harsh environmental conditions and lack of reliable power on the playa presented unusual technical challenges. The enormous amount of data collected also provided analytical challenges.

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