

The Emotional Nature of Global Consciousness

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ABSTRACT

Over the past 10 years, the Global Consciousness Project has repeated a basic hypothesis test about 250 times. The hypothesis is that data collected from a globally distributed network of physical random sources during major world events will show non-random structure. The research derives from laboratory work with individuals, exploring possible interactions of human consciousness and emotions with physical systems. A technology using Random Event Generators (REG) for assessing such interactions was extended to field work with groups, and ultimately to a world-spanning network collecting random data continuously to allow assessment of globally shared cognitive and emotional states.

The composite result (equivalent to a meta-analysis of replications) across all formal tests confirms the general hypothesis with a 5 sigma departure from expectation. The chance probability is less than 1 in 10^6 , but the average effect size is small, equivalent to about 0.3 sigma. This means we cannot expect individual events or hypothesis tests to provide answers to specific queries about what factors are important contributors to the effect. However, by sorting the events into a limited set of categories, we gain sufficient statistical power to ask such questions.

Several emotions are identifiable at various levels in the world events, and subjective ratings can be made with good reliability. While not all events can be assigned to such categories as William James' four basic emotions, or the modern set used by Klaus Scherer's Geneva group (Scherer, 2005), categories such as "fear/anxiety", "positive feeling", and "compassion/love", all yield adequate samples to assess the presence of these emotions in an operationally defined "global consciousness". Events with either strong positive or strong negative valence produce significant effects, while neutral events do not. The level of emotion regardless of valence is a highly significant predictor ($p < 0.005$). The largest effect sizes in the database are produced by events characterized by fear (4.5 sigma), or compassion and love (3.6 sigma).

Our findings suggest that: 1) an unknown mechanism links consciousness with physical systems, yielding detectable changes in their behavior, 2) there is a non-local interconnection of human consciousness at an unconscious level, and 3) an operationally defined "global consciousness" is emotionally responsive in ways familiar from studies of individuals and groups, giving the construct face validity.

INTRODUCTION

In 1995, when Israeli Prime Minister Yitzhak Rabin was assassinated, a continuously running random event generator (REG) in the School of Engineering at Princeton University showed a strong departure from its expected behavior. While this might have been a coincidence, albeit against 100 to 1 odds, another possibility is that the correlation between the terrible and saddening world-changing event and the REG's deviation from random behavior might be meaningful, not accidental. We had, in the Princeton Engineering Anomalies Research (PEAR) program, already found that an REG in a social context conducive to deeply shared emotions or coherent states of mind often showed persistent deviations from expectation. This research paradigm, started in early 1993, was called "FieldREG", in a double entendre referring to field studies looking for evidence of consciousness fields (Nelson, et al., 1996, 1998b). The overall results of this program over several years and about 90 applications (independent hypothesis tests) were highly significant, with odds against chance on the order of a million to one.

The work was replicated in other labs (Radin, et al., 1996; Bierman, 1996), and variations examined effects of differing venues, types of events, and factors such as geographical separation and the use of multiple REG devices. Although the FieldREG paradigm is in principle a "natural experiment" in the sense that no manipulation of conditions is feasible, it is possible to do comparative assessments by selecting the occasions and venues for data collection in well-defined categories, and by prospectively identifying periods of time and hence data subsets corresponding to particular moods or levels of emotion (Radin, et al., 1996; Nelson & Mayer, 1997; Nelson, et al., 1998b; Blasband, 2000).

In 1997, these explorations matured to a prototype for the network approach used by the Global Consciousness Project (GCP). In January, data were collected from 14 REGs in Europe and the US before, during, and after an event called Gaiamind, which was a widely advertised and promoted meditation event. The composite data during the synchronized meditation showed a significant departure from expectation (Nelson, 1997). In September 1997, the same *ad hoc* arrangement was made to collect data during the funeral ceremonies for Princess Diana, and a week later, for Mother Teresa. The nominally random data from a dozen REGs showed statistically significant structure during the former, but not the latter event (Nelson, et al., 1998a). These results and those from the earlier FieldREG research motivated a decision to create a long-term experiment that would enable us to ask the same kind of question about other great events on the world stage.

A group of colleagues designed a conceptually simple, though technically sophisticated long-term experiment. Skilled programmers created software to collect data continuously at nodes in a synchronized, globally distributed network and transfer the data over the Internet to a central archive using secure communication protocols. The GCP network began operation in late 1998 with a few nodes and grew to its present scope of about 65 nodes over the next few years (Nelson, 2002). Each node consists of a research grade physical REG and custom software to collect and sum 200 bits per second, store these "trial" values locally, and transmit them automatically to a server in Princeton for archiving and later analysis.

PROCEDURE

The general hypothesis of the GCP is that there will be correlated structure found in the nominally random data during major events in the world that engage the attention of large numbers of people. This proposition is tested in a series of replications formally specified in a registry prior to examination of the data. The beginning and end of the event are defined, and the corresponding data are extracted for analysis using the pre-specified statistical procedure (Nelson, et al., 2002; Nelson & Bancel, 2006; Bancel & Nelson, 2008). The selection of events is determined by what is happening in the world and is largely dependent on media interest. A variety of types of events have been assessed, including wars, terror attacks, major accidents, and natural disasters on the negative side, and celebrations, religious gatherings, organized meditations, and peace demonstrations on the positive side. The criteria for selection are not algorithmic but focus on events that generate deep engagement and widespread, potentially global interest. The selection has been designed to explore a range of types of events that might yield informative results, including comparisons of factors such as emotional categories and levels, and contrasts of emotional vs. intellectual content.

It is important to note that while the events are not chosen according to algorithmic or fixed criteria, the hypothesis testing in the formal GCP experiment is statistically and scientifically valid. All parameters are specified in advance of analysis for each of the individual events, and results for all the analyses are reported and included in summary statistics. Thus, although we are not attempting to falsify a theory, each of the events in the replication series is a fully qualified hypothesis test with an interpretable outcome expressed in a statistic that can be evaluated against a theoretical or empirically derived distribution. The experiment as a whole can be described as testing a composite hypothesis that generalizes the separate event-based hypotheses, addressing the question whether there is evidence for structure in the GCP data correlated with major events.

Most events are assessed with a standard analysis called the “network variance” (netvar), which produces a Chisquare distributed quantity with 1 degree of freedom for each second during the event. The netvar is the squared Stouffer Z, or Chisquare across the n REGs, $\chi^2 = \sum_i^n z_i^2 / n$. Chisquare is additive, allowing calculation of a figure of merit for the event as the sum of second-by-second Chisquares over the duration of the event, with degrees of freedom equal to the number of seconds. This is reported as an equivalent normal Z-score (sigma) for the event. A few events are assessed with a device variance (devvar) measure, which is simply the variance across the trial scores for the n REGs per second. With appropriate normalization, these can be aggregated with the rest of the series since they ask the same basic question whether there are anomalous deviations during the specified events. Some 247 formal replications of the simple experiment have been made over the lifetime of the GCP, and they can be combined to yield an overall statistic representing the general hypothesis that the random data may show structure correlated with major events.

RESULTS

The bottom line result for the 9-year database of formal replications is a roughly 5 sigma departure from expectation ($Z = 5.121$ as of March 2008), which translates to odds against chance of somewhat more than a million to one. That is, chance fluctuation is a very unlikely explanation for the accumulated evidence across 247 tests of the hypothesis that there will be *structure in the GCP data correlated with major events* in the world. Figure 1 shows this result graphically as a cumulative sum of departures from expectation over the series of tests. There is a tendency for the individual outcomes to have a positive deviation in accord with the prediction, and this accumulates fairly steadily over the long sequence of replications. Such a graph should show an unbiased random walk with a generally level trend if there is no anomalous correlation, and this is indeed what we see when we create control “trials” by resampling from the full database using the same trial structure. But the actual data corresponding to the registered events of the formal experiment show a trend of accumulated positive deviations. Although the individual hypothesis tests yield small and variable effects, the composite yield is highly significant evidence for the hypothesized correlation.

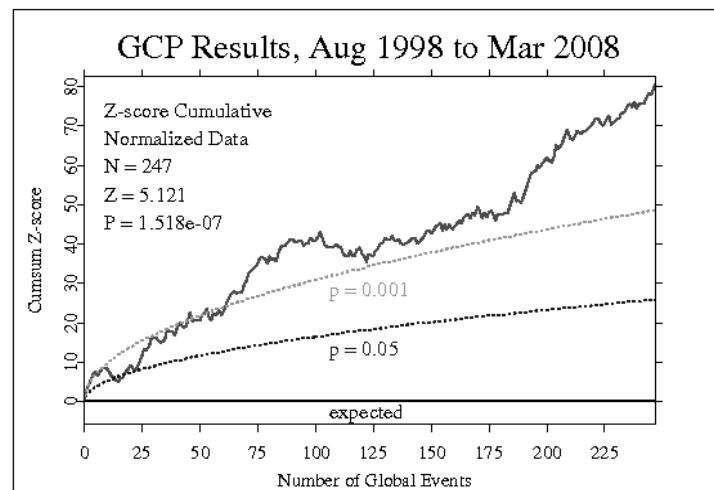


Figure 1. Cumulative total deviation of results for 247 formal hypothesis tests. The dotted smooth curves show the 5% and 0.1% significance criteria. A truly random trace would fluctuate around a level trend at zero on the ordinate.

We thus have persuasive statistical evidence of non-random behavior in a network of research quality physical REGs, apparently driven by shared emotions or broadly synchronized attention of humans. It is important to re-emphasize, however, one aspect of the finding that is not immediately apparent: While the 5-sigma result is impressive, it is a concatenation of small effects accumulated over a large database. For an individual event the best estimate is the average Z-score, which is $\bar{Z} = 0.313$ calculated over the 247 events. This means that we cannot expect individual events to reliably show significant deviations.

On the other hand, it may be the case that certain kinds or categories of events will have larger (or smaller) effects on average, a question we will consider in some detail.

EMOTIONAL CATEGORIES

The name “global consciousness” may seem to imply a theory that we hope to test but our intent is more modest. The term is actually an operational definition. We propose that when very large numbers of people are deeply engaged by shared thoughts and emotions, a condition is created where we will find anomalous structure in data from the REG network. This is what we call global consciousness. Going a step further to study this operationally defined condition, we can look for recognizable or familiar qualities, asking whether it exhibits properties that are similar to ordinary individual consciousness. For example, is there any evidence that the effects we see relate to emotional categories in a systematic way?

Although ratings and assignments are necessarily subjective and have intrinsic variability, it is possible to sort the 240-plus events into categories that represent various questions. For example, we can estimate the numbers of people engaged by the events and sort them into small, medium, and large categories with sufficient reliability to make useful comparisons. Simple t-tests of differences in effect size reveal that large events contribute most of the anomalous effect in the database; the difference between large and small is significant ($p = 0.017$, two-tailed). We might interpret this as showing that a more complete or intense focus of our communal consciousness produces a stronger effect. This accords with most observers’ intuitions; it makes sense and acts like comparisons of a similar nature in psychology and sociology.

It is yet more interesting to look at emotions represented in the events, as shown in Figure 2, which shows the formal events with high, medium, and low levels of emotional content.

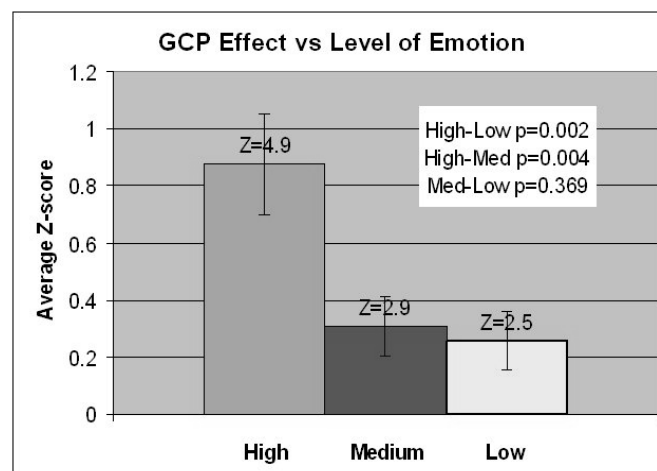


Figure 2. Formal events sorted into levels of emotion show significant differences between those with high levels or intense emotions and either low or medium levels. Error bars are 1 sigma.

When we examine this question statistically, we find that events categorized as having a high level of emotional impact are much more likely to affect the GCP network than those rated as medium or low in their emotional content (two-tailed $p = 0.004$ and 0.002 , respectively).

Again this accords with reasonable expectations derived from personal experience. If we are powerfully engaged by an emotional state, it will absorb our attention and resources, and will have relatively strong effects if we take actions. High emotions are easy to detect or, conversely, hard to escape or obscure. They gather us into a singular and sharply focused mode that is functional, preparing us, for example, to “fight or flee”. While the GCP data can't be interpreted so richly, they show clearly that stronger emotional content in our formal events corresponds to greater correlated deviations.

When we ask about different qualities or kinds of emotions, we find that both negative and positive feelings (e.g., fear and love) are associated with strong effects in the GCP data at roughly the same level, as shown in Figure 3. Events that evoke neither of the extremes show apparently less powerful effects, but none of the differences in valence are statistically significant.

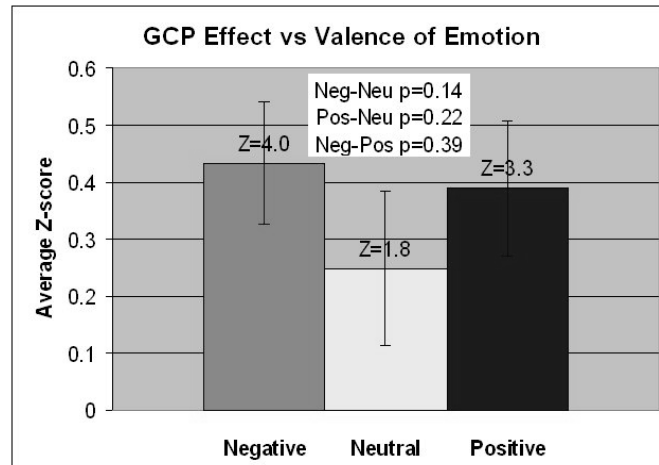


Figure 3. Formal events sorted into negative vs positive emotions show little difference between the categories, while both have significant effect sizes relative to expectation. One sigma error bars.

Looking at specific emotions, we find that some stand out. For example, those events that evoke or embody a high level of compassion have a much larger effect size than those with a low rating (two-tailed $p = 0.025$). Figure 4 displays the average Z-scores for three groupings representing high, medium, and low estimates of the degree to which love and compassion are found in the events. Those with a high level have an effect size almost twice the average in the full database.

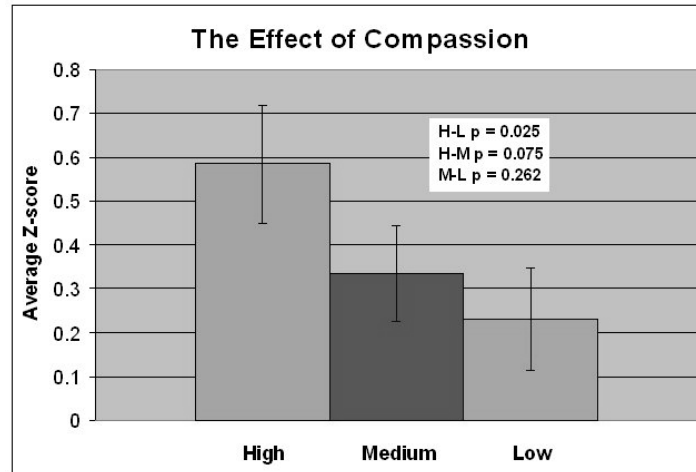


Figure 4. Formal events sorted by the estimated degree of compassion evoked or embodied by the events. Effect sizes are proportional to the strength or depth of the emotion. One sigma error bars.

To summarize the findings across a number of such investigations of the GCP data, it appears that our hypothesized global consciousness responds to events in ways that are recognizable, indeed quite familiar to us as individuals. In the 19th century, William James wrote about emotions, attempting in his inimitable prose to say what emotions really are. His idea, at first very difficult to understand or believe for most people, was that emotions *follow* physical responses to situations – we run because we are afraid, not the other way around (James, 1884). The idea has been discussed and disputed over the decades, and it seems contrary to the “fight or flee” proposition cited earlier. Nevertheless, it is fair to say that his simple categorization of emotions is still worth considering. He suggested that most emotions could be allocated to just four categories, fear, love, grief, and rage. Figure 5 shows the GCP results assigned to this simple scheme, which also reflects in a general way more contemporary work on emotions attempting to define and clarify their role (Ekman, 1999; Scherer, 2003). We see that most of the events can be accounted for in this very basic set of emotions, with a small number that don't fit. The result is interesting, and suggests that by far the largest contributions to our bottom line come from the two general emotional domains signified by fear and love. Only relatively few events in our database can be identified with the emotions of grief and rage (see the large error bars), but in the sample we have, neither category produces a significant deviation from expectation.

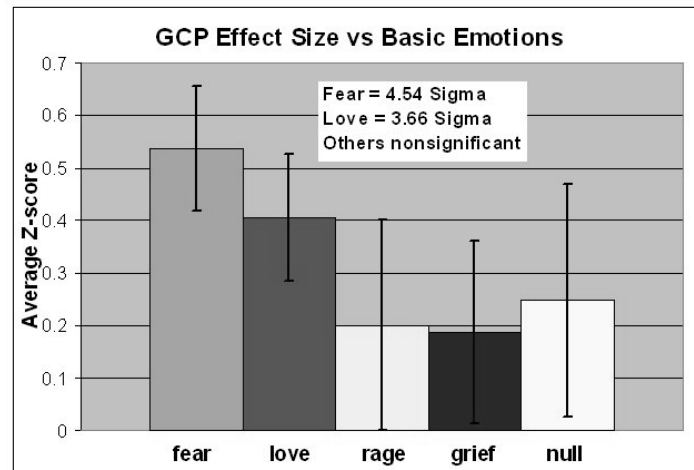


Figure 5. A general model of basic emotions described by William James in the 19th century is fitted to the formal GCP event scores. The result shows fear and love significantly impact the REG data, but rage and grief do not. One sigma error bars.

MULTIPLE PERSPECTIVES

The search for explanations and for causal relationships remains ahead of us, but work toward that end already yields interesting results. Over the past several years, the GCP analysis has benefited from applying an array of sophisticated and powerful statistical tools (Bancel & Nelson, 2008). This work includes description of independent perspectives and measures that confirm the original analyses. It begins with a rigorous normalization using empirical estimates for the mean and variance for each of the s (this ensures that the results are not affected by the slight variations expected from real-world devices relative to theoretical randomness). Given the normalized data, it is possible to create a number of informative pictures in addition to the event-based analysis, for example, visualizing long-term changes and structure. This allows us to look at overall trends and at correlations of the data with external variables representing social issues and conditions.

In an earlier analysis, we found that average daily correlations among the REGs are slightly stronger when an independent measure of “news intensity” is high (Radin, 2002). This is a similar perspective to that provided by categorizing the events according to the level of emotion evoked, but with a broader, more general purview. When we look at the database as a whole (that is, all the data, not just the segments that constitute the formal event experiment), it becomes evident that there may be some general structure – the data are not a simple random sequence. A long and steady trend begins late in 2001 and persists for several years, and it can be established through analysis of statistical models that this trend is significant, with a likelihood on the order of 1 in 100 that it is chance fluctuation. This is an indication that our long-running database of physical random numbers is affected by external factors which, if we can identify them, will richly inform our understanding.

It seems especially appropriate to consider psychological or social measures with a global reach. There are numerous possibilities in principle, but useful comparisons require a long term database of repeated measures on the variable in question. For example, public opinion polls often ask similar questions to allow comparisons of ratings over time, and some questions are essentially constant. An interesting candidate measure for our purposes is presidential approval ratings drawn from repeated polls over the years. In the event-based experiment we have seen that the network variance statistic correlates with short periods of collective, emotive behavior. Here we ask whether emotive behavior which fluctuates on a time scale of weeks and months can also be seen to correlate with our measure of global random data. When we compare the polling data sequence with the GCP network variance, there is some similarity in the overall trends and suggestive matching of details. Figure 6 shows the long-term GCP data sequence, which should be a level random walk, together with the sequence of poll ratings of presidential approval drawn from the repeated instances of the question in several different polls. The data are rescaled for plotting at the same level, allowing a visual comparison of trends. A simple 2-parameter model (current value and 14-day slope) of the polling data attempting to simulate the GCP data yields parallel structure that is even more striking than the raw data comparison, and the parametric correlation is significant.

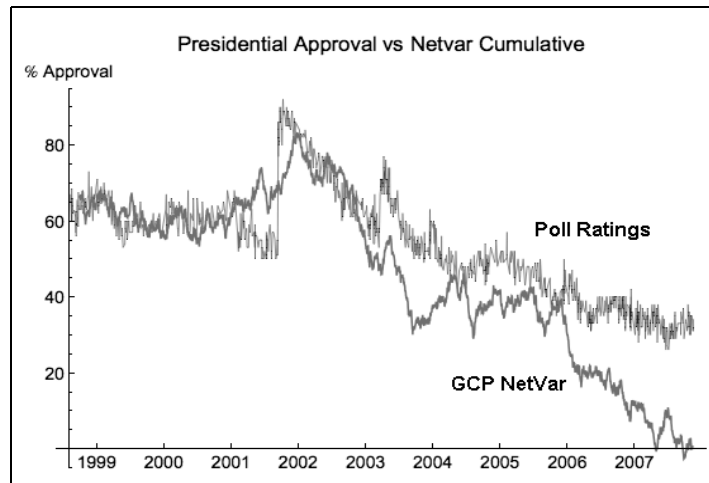


Figure 6. Cumulative deviation of the GCP network variance (darker, smoother curve) compared with raw Presidential approval ratings from 14 US polling firms (sources: pollingreport.com, ropocenter.uconn.edu). Netvar scale is adjusted to plot the two curves in the same numerical range.

Thus, over the long term, GCP data appear to be correlated with a sociological measure, the presidential approval rating. This is largely a US-centric measure, but the powerful effects of decisions by the US president in the rest of the world make the polling data a useful window into the global state of consciousness. We do not claim or wish to suggest that there is a causal relationship with feelings of approval (or not) directly affecting the

GCP data. Instead, we can think of this result as an interesting plausibility exercise, which encourages ongoing efforts to establish linkages of GCP data with other indicators of broadly shared perceptions and emotional states.

DISCUSSION

The Global Consciousness Project is first and foremost an empirical exercise. It is a network of high-quality physical random event generators using software and the Internet to create parallel, synchronized sequences of numbers which are expected to meet the classical definitions of randomness. Calibrations and sophisticated analyses, including a detailed vetting to eliminate any bad data produced by the occasional malfunction, show that the data do in fact meet such standards. We find the devices are stable over years of operation, with infrequent instances of excluded data usually traced to hardware failure or electrical supply problems. The final normalizations produce approximately standard normal trial values which can be safely input to analyses; the parameters for the first four moments of the distribution of data from the formal events show expected values (Bancel and Nelson, 2008). Simply put, the continuous sequences of GCP data satisfy all standard criteria for randomness. This is the background for our experimental work.

The event experiment was designed to allow exploration of a number of questions beyond the attempt to determine whether there is non-random structure in the data that correspond to global events. For example, given the discovery of such structure, we ask what factors contribute to the effects we find. We can look for internal variations depending on distance, either from the nominal locus of the event, or between the REGs in the network. We can look for correlation with geophysical and cosmic variables, and assess time series characteristics such as diurnal variation. But for the purposes of this paper, we address the influence of event types, in particular, categories corresponding to ordinary human emotions.

This exploration reveals that there are very strong differences of effect size depending on emotive categories, and while the analysis depends on subjective estimates of levels and kinds of emotion, the agreement of independent raters or categorizers is good. Since the data and results are fully accessible to the public via the GCP website, we can invite independent assessment of the questions. Three such efforts have been made, albeit in an informal way. They all confirm our general findings, including the effects of emotional level and valence, and one of the independent assessments which specifically focused on love and compassion confirms our result for that question. We can conclude that although the “global consciousness” under discussion is simply an operationally defined concept, it gains some ecological or face validity based on the second-order structure discovered through the categorization analysis.

The GCP event experiment provides evidence for an anomalous effect on random event generators, apparently linked with human consciousness. The effect is too small to be clear for single events, with an average effect size of about 0.3 sigma. But in the long series of replications over almost 10 years, the composite result is statistically significant with probability less than 1 in a million that we are looking at chance fluctuation. Even more

interesting, the data and the deviations from expectation have internal structure that makes the picture compelling. The findings suggest that whatever drives the data to deviate from randomness is responsive to or modulated by emotional characteristics of the events. We draw three primary conclusions: 1) subtle changes in the behavior of physical random processes are linked with identifiable special states of human consciousness, 2) the event correlations imply non-local interconnection of human consciousness at an unconscious level, and 3) the conceptual “global consciousness” thus produced is emotionally responsive in ways familiar from studies of individuals and groups.

This is far from saying that there is a real “global consciousness” that exists independently from our interactions and activities, but there is a clear implication that we should be looking for some way to understand the apparent functional interconnection of great numbers of people via their shared responses to events. Even on a global scale, it may be that emotions play the useful role described by Ekman: “the primary function of emotion is to mobilize the organism to deal quickly with important ... encounters, prepared to do so by what types of activity have been adaptive in the past.” (Ekman, 1999)

The effects and the secondary structure in the data are not predictable from the standard models of physics and psychology, but they are significant and robust against efforts to find mundane explanations for them. We do not have a working explanatory model, but the focus of our continuing analytical work is to locate and define more sharply the anomalies in the data, looking for parameters and dimensions that will constrain the possible models. Some of these are in the physical realm, e. g., distance dependence, and some in social and psychological areas such as those discussed here, but also including more quantitative measures, e. g., news coverage statistics. These efforts should lead ultimately toward the ability to ask more formally whether there is a true global consciousness in the making, and if so, what that implies for us as individuals and societies.

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