Incremental Shifts in pH Spring Water Can Be Stored as "Space-Memory": Encoding and Retrieval Through the Application of the Same Rotating Magnetic Field

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ABSTRACT

Both four-dimensional (space-time) models and Casimir-like processes predict that the representations of stimulus-response pairing remain in altered or virtual states that can be potentially retrieved. Over a six month period we demonstrated "excess correlations" between mild acidification in quantities (50 ml) of spring water in a local space and the temporally contiguous incremental alkalinisation in nonlocal quantities of water when both loci were exposed to the same experimental paradigm that produced "entanglement" in photon reactions. The procedure required simultaneous exposures of both loci to specific patterns of rotating magnetic fields displaying specific rates of change in angular velocity. If the ~0.1 unit increases in pH within the non-local water samples due to injections of acetic acid in the local samples had been established on one day, comparable shifts occurred in the non-local water samples the following day when there were no injections of acetic acid if the space was exposed to the original magnetic field configurations. These results suggest that, like photon patterns, the "memory" or representation of pH (H^+) shifts remain in space long after the stimulus has been removed and can be retrieved within that space if the specific electromagnetic field is repeated.

Key Words: excess correlation, space-time, quantum information, retrieval, water

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Introduction

Excess correlations, or entanglement, may be considered events between two spatially separate loci displaying synchronous activity without an intermediate mechanism or agency such as a force or charge (Ahn *et al.*, 2000; Arneson *et al.*, 2001). Our laboratory has previously demonstrated experimentally-induced excess correlations between processes occurring in two separated loci that were each enclosed within circular arrays of solenoids in which rotating magnetic fields with changing angular velocities were generated (Dotta *et al.*, 2011; Dotta *et al.*, 2012; Dotta *et al.*, 2013). This excess correlation can be considered a form of macroscopic entanglement or "macroscale" non-locality. From some approaches non-locality has been considered the "anomalous" action at a distance resulting in excess temporal correlations between two spatial loci (Stapp *et al.*, 2009). This

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means that when a pattern of events occurs in one of the loci there is a correlation above random variation (chance) with the pattern of events occurring in the other locus. Theoretically there is no spatial limit to non-locality. If it occurs, a pattern of events occurring in one location could display (at least in principle) excess correlation with patterns of events in the second locus located at the other side of the universe (Koren and Persinger, 2013).

Previous research (Dotta *et al.,* 2011) has shown an "excess" correlation of the irradiance or power density of photon emissions with pairs of cell cultures or pairs of human brains when they are separated by non-traditional distance if both shared the same, very specific type of circularly rotating magnetic field with specific rates of changing velocities. These excess correlations or entanglements required photomultiplier tubes (PMT) to be discerned but were also evident through quantitative electroencephalography (Dotta *et al.,* 2009; Dotta *et al.,* 2011). These excess correlations, that is, the increase in photon emission from one locus when light (LED administration or chemical reaction) was applied to the other locus only occurred when the shared rotating magnetic fields were applied synchronously to the two separate sites. The effect was not obvious when light was applied to one locus and photons were recorded from the other locus if the specific magnetic field configurations were not present. Non-specific magnetic fields, particularly exhibiting no changing angular velocity or second derivative (a rate of rate of change) did not reveal the effect.

Creation of excess correlation between two spatially separated loci also produced long term effects within the space as well (for ~10^5 s). We have previously described a potential "space-memory" when a specific rotating magnetic field with specific changes in angular velocity was applied daily in the same space (Persinger & Dotta, 2012). This experiment involved applying the complex electromagnetic fields coupled with injections of H_2O_2 into NaClO. This reaction produced reliable spikes in photon emissions from the PMT. In addition, it was noted that different experimentally manipulated temporal patterns of the photon emissions occurred as "spontaneous" spikes up to 3 (and sometimes 5) days after the actual injections when the same magnetic field configuration was present but no injections occurred. These results indicated that temporal patterns of entangled photon emissions were "stored" within locally entangled space-time and could be retrieved long after the events had been generated.

One application of Minkowski's space-time equation is that information within a fixed 4-dimensionsal coordinate is protracted long after the stimulus event has ceased in present space. This indicates that space itself can contain a representation of events that can be retrieved after removal of the original stimulus. Representation of stimuli within a space after the stimuli ceases to be present defines the concept of memory. Typically the representation in cerebral tissue involves the transduction of the actual stimulus into electromagnetic patterns that are then transformed to spatial patterns of spines that are formed on dendrites. From contemporary perspectives of neuroscience, the spatial pattern of these spines over large brain volumes *is* the memory.

From an operational perspective memory is defined as [(A,B), Δt, (A_B))] where A is the locus of reference, B is the presence of a transient stimulus, Δt is the elapse of time since the removal of B, and A_B indicates the residual or representation of B occurring within the locus of A. From this perspective the residual magnetization of iron following the removal of the applied magnetic field is memory. The alteration of a DNA sequence by a single event that results in generational differences, the modification in a belief in a culture of human beings because of a meaningful occurrence centuries before, or the persistent changes in cells within the immune system due to a single retrovirus introduced decades ago would be examples from different levels of scientific discourse.

There is metaphorical and experimental evidence that "space" may display memory. Whether or not one employs the mathematical construction of Hilbert space or Minkowski space or the concept that the geomagnetic field maintains subtle "impressions" of movements of matter and energy within it, information from a previous time should still be accessible within that locus. Here we report an additional example of potential space memory that was produced by the application of specific temporal rotating magnetic fields in two loci. In this instance the "memory" involved discrete shifts pH within fresh samples of spring water assuming excess correlation between the two loci had occurred recently. We selected pH rather than photon emissions because the equipment is inexpensive and relatively easy to access. The phenomenon involves shifts in discrete amounts of matter (H^+/OH^- ratios).

Methods and Results

We performed over 60 experiments on separate days over a 5 month period with our traditional (Persinger & Dotta, 2011) experimental design but applied to shifts in pH within 50 ml quantities of spring water. We simultaneously applied two patterns of frequency "phase"-modulated magnetic fields for a total of ~16 minutes within two spatially separated (10 m) loci within different rooms. Each locus received identical patterns and intensities (1 μT in the center of the locus) of counter-clockwise rotating magnetic fields. They were generated by computer-programs and delivered as successive activations for discrete durations in a circularly array of 8 solenoid (Figure 1).

Simultaneous pH measurements were recorded once per second for the duration of the experiment at each locus. The pH values for both beakers in each experiment were recorded separately once per second by Dr. Daq systems (Pico Technology, United Kingdom) which are sensitive to the .01 pH unit. The first (AD) field was applied from minutes 0 thru 6 and the second (DI) field was applied from minutes 7 thru 16. The pattern of the AD and DI fields can be seen in Figure 2. The "A" in AD refers to the accelerating angular velocity of the magnetic fields that were generated in each solenoid. In this instance the duration of the field in the first solenoid was 20 ms and then decreased by 2 ms in each succeeding solenoid (total time for one rotation: 108 ms, i.e., 9.25 Hz). The "D" in AD refers to the decelerating phase-frequency modulation of the patterned field that was generated in each of the solenoids. Because the point duration was 1 ms and the numbers of points in the pattern was 859, this means approximately 8 complete rotations around the perimeter composed of the 8 solenoids were completed before the pattern was repeated.

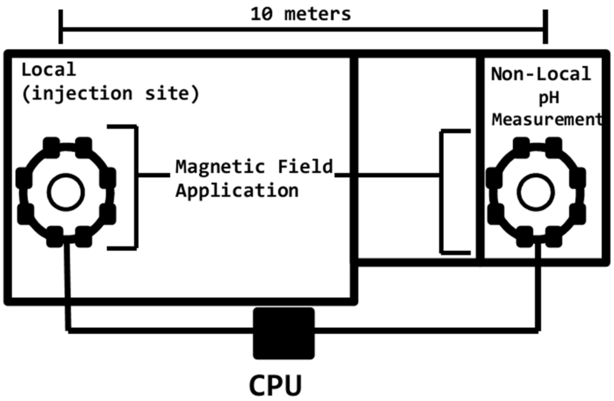

Figure 1. Diagram of the experimental design. There were two separate circular arrangements of 8 solenoids within which the flasks of spring water (circles) were placed. A computer generated the changing angular velocity and phase modulated fields within the two arrays. The proton donor (acetic acid) was injected into the local flask. pH levels were measured every second form the local and the non-local flasks. The latter never received any injections.

The "D" in the DI field indicated that the angular velocity of the pattern around the circular array of solenoids was decreasing such that the duration of the field in the first solenoid was 20 ms and then the duration increased by 2 ms for each successive solenoid. The total time for one rotation was 216 ms (4.63 Hz). The "I" in the DI refers to the increasing frequency-phase modulation of the pattern of the induced field. It was composed of 230 points; consequently there was about one complete rotation per pattern.

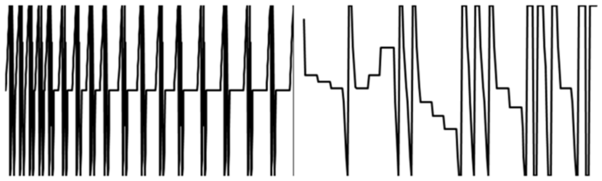

Figure 2. Pattern of the frequency-modulated fields (AD & DI) employed in the experiments. Vertical axis refers to amplitude (1 to 256 or -5 to +5 V) and the horizontal axis refers to serial order of the voltage. The duration of each value (point) was 1 msec.

After 4 min of exposure (during the AD field) the first injection of 50 μL of 0.83 M acetic acid (proton source) was injected into 50 ml of water contained in a 125 ml Erlenmeyer flask. It was designated as the "local" flask. One minute after the onset of the second field (8 min from the beginning of the experiment), 50 μL was injected into the local flask every min until the 16^{th} minute of the experiment (9 total injections). The shift towards acid pH was increased predictably over trials in the water in the local flask. *Nothing was ever injected into the non-local 125 ml flask that contained 50 ml of water*. Only pH was measured at the same time as it was measured in the local flask. For control experiments pH values were measured in both flasks over the same duration but no proton sources were injected and no experimental magnetic fields were present. This procedure was completed to control for any potential serial drifts in equipment or water-atmospheric interactions.

The very specific magnetic field presentation was required to produce the "excess correlation" in pH between the two separated flasks. Both flasks were exposed optimally for 6 minutes to a rotating magnetic field with an angular acceleration containing a decreasing phase modulating pattern (or a "decreasing phase velocity") during which time no increase in pH was noted. However when both flasks were then exposed for an additional 10 minutes to a rotating magnetic field with decreasing angular acceleration but increasing phase-modulated field pattern ("increasing phase velocity"), the increased pH in the non-local flask was reliable and conspicuous.

As reported recently by Dotta et al (2013) the injection of protons into the water within the local space produced discrete decreases in pH (towards acidity). During the DI phase, similar to what was observed for the photon doubling effect (Dotta and Persinger, 2011), the non-local space displayed the opposite discrete (~0.03 pH units) increases (towards alkalinity) in pH. The simultaneous decrease in pH in locus 1 and the increase in pH in locus 2 would be consistent with their "superimposition" (that is behaving as if they were the same space) where there would be a maintenance of the "equilibrium" of H^+ and OH^-.

This process, in addition to a manifestation of Newton's Third Law: for ever force there is an equal and opposite force, might be considered analogous to the shift to the opposite polarity of one photon when it's paired ("entangled") photon undergoes a polarity shift. The associated fixed energy per H^+ (proton) from the shared applied magnetic fields was calculated to be $\sim10^{-21}$ J. This is within the range of the threshold, the Landauer Limit (kT ln2, or $\sim2.8\cdot10^{-21}$ J) where bits of information are lost to or gained from entropy. Here k=Boltzmann's constant and T=temperature in degree Kelvin and ln2=0.69.

Over days with successive experiments it became evident that there were spontaneous increases in pH (towards basic) in the non-local flasks of water once the field had been initiated at the beginning of the experiments even though no acetic acid had been injected into the local flask. There was also no reliable shift in pH within the local flask. To test experimentally if there was a "space-memory" effect seen in previous research (Persinger & Dotta, 2011) we alternated days when the fields were either on or off and injections of acetic acid either occurred or did not. This alternating design was implemented to demonstrate that the pH shifts could be encoded and retrieved on sequential days assuming the appropriate magnetic field characteristics were applied. All experiments were completed in triplicate. The intrinsic reliability for specific shifts indicated this number of replications was sufficient.

We found that comparable discrete increases in pH occurred within the water within the non-local flask on days when there was no injection into the local flask. The effect required: 1) the presence of the specific pattern of magnetic fields that was associated with the "entanglement" or "excess correlation" effect (Dotta *et al.*, 2013), and, 2) occurrence of this excess correlation the previous day (24 hrs previously). The phenomenon was very similar to that observed for the original spontaneous photon emissions without injection of reactant within the entangled, non-local space reported in 2011 (Persinger & Dotta, 2011). As can be seen in Figure 1 there was a clear increase in pH in the non-local flask despite no injections occurring at the local flask. The increment of change in pH was comparable to that measured in the non-local space when acetic acid (protons) was actually injected into the local space.

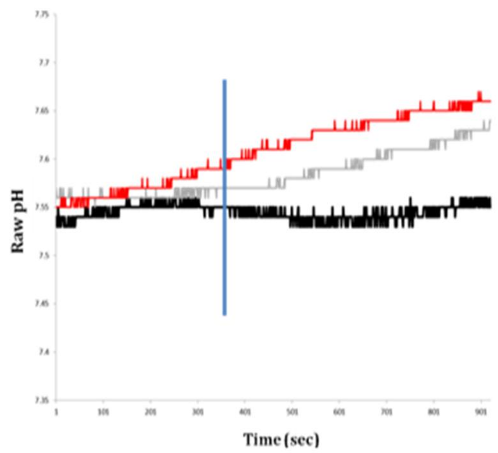

Figure 3. The absolute shift in pH for baseline condition (black), "encode" condition (grey), and retrieve condition (red) of spring water within the non-local flasks as a function of time. The vertical blue line indicates when the second phase of the excess correlation sequence was initiated.

There appeared to be a quantum memory that was dependent on the field being presented twice in the same space. Stated alternatively, the field had to be presented during the injections procedure to "encode" the pattern and then again during the no injection procedure, to "retrieve" the pattern.

Over the course of several weeks there was a subtle increase in the baseline non-local pH if there were several sequential days of experiments to produce excess correlations. As an additional test, we paused testing for 1 month to achieve a complete control experiment as defined by no significant variation in non-local pH during control conditions. After "multiple pairings", that is successive days in which excess correlations occurred between the decreased pH in the local space and the increased pH in non-local space, there was again a clear "retrieval" phenomenon that was contingent upon "storage" the previous day. The average shifts in pH in the non-local flask for the various conditions can be seen in Figure 4.

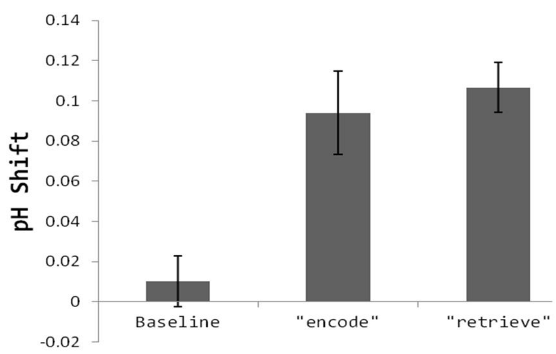

Figure 4. Average pH shifts from the non-local flask containing 50 mL of spring water. Baseline conditions produce no drift in pH while "encode" and "retrieve" conditions produce similar drifts (~0.1 pH units) in pH. These two conditions are not different from each other but are both significantly higher than controls.

In both the "encode" and "retrieve" conditions there was a shift towards basic of about 0.1 pH units ($F(2,12)=36.25$, $p=<0.001$, $eta^2=.88$). This pH shift was not apparent in control conditions. The correlation between pH shifts for the "encode" and "retrieve" conditions was extremely strong (r~.85). These results indicated that the recreation of the same patterned electromagnetic condition that occurred during non-local pH shifts on the "encoding" day could reconfigure as very similar levels of "spontaneous" pH shifts during the following day.

Discussion

The results of these experiments support the observations from previous experiments (Dotta *et al.,* 2012) that once excess correlations between local and non-local photon emissions have been established through shared exposures to a specific sequence of changing angular velocities of rotating magnetic fields within circular arrays of solenoids a type of "space-time memory" occurs. The application of the same sequence of magnetic fields the following day without the chemical reactions that produced the photon emissions was associated with conspicuous photon emissions whose energies were comparable to those involved with those reactions. The likelihood of artefact was minimal because the specific range of interstimulus intervals for the chemical reactions that the produced the photon emissions during the entanglement process were reflected precisely during the "retrieval" experiments when only the magnetic fields were applied.

This specificity indicates that the "retrieval" of photon emissions was not being directly caused by the magnetic field *per se* but that the field was "accessing" the space-time conditions of the previous day. In the photon study the retrieval effect (which occurred only once if the field without the chemical reactions was activated) was evident for about three days following a day in which entanglement or excess correlation had been established in that space. Longer temporal intervals were not associated with the phenomenon. The reliable absence of the phenomenon after intervals of three days despite the activation of the magnetic fields also supports the phenomenon's veridicality.

However photon emissions require photon multiplier tubes and must be performed in darkness. We selected pH as a potential phenomenon to establish excess correlations between local and non-local spaces employing the same procedure and sequence of magnetic fields because the measurement devices (Dr. Daqs) are easily accessible, inexpensive and can be completed within ambient lighting. In previous experiments (Dotta *et al.,* 2013) we demonstrated that the incremental addition of a proton donor (acetic acid) to water and hence increased acidification in local space was associated with a simultaneous drift toward alkalization in non-local space in which no substance was injected. This parity, defined as reversal in polarity in one locality upon the alteration of polarity in the entangled space, has been considered to be a defining characteristic.

That the intensity of the applied magnetic field was the potential source of the energy that contributes to "how much" information can be entangled was shown as well in the Dotta et al (2013) experiments. The applied field of ~1 μT (within the center of the circular array of solenoids) produced the maximum incremental shift in pH with 25 cc of spring water, approximately half of the effect within 50 cc of spring water and no effect in 100 cc. In that study we calculated that the magnetic energy per H^+ within the hydronium ion would have been ~10^{-21} J. This is within the range of energy involved with the transition of information (a bit) from real to virtual status, or stated alternatively, movement from order to disorder (entropy).

The present results indicate that the increased pH within the non-local space occurring congruently with the decreased pH in local space, a manifestation of entanglement, resulted in a representation within the non-local space. If it were a Casimir-like condition whereby virtual particles become real particles in the presence of magnetic field with changing spatial boundaries, then the reapplication of the same field that produced the entanglement would allow the retrieval of the "same" effect. Our measurements that the quantity of shift in pH within the non-local space during the entanglement process did not differ significantly from the quantity of shift during the "retrieval" phase 24 hr later would support this interpretation.

In the present experiment we did not measure if the "retention" of the potential for pH to be shifted occurred for longer durations than 24 hrs. Although subsequent experiments indicated that it was still evident after 48 hr, the sample size would not be sufficient to be definitive. If the effect is similar to what we found for the space memory of photon emission patterns, then the capacity to retrieve the effect should be minimal after about three days.

One of the casual observations we have noted in different experiments is that the more trials of entanglement every day within a space the more the response in the non-local area drifts in the opposite direction from that in the local area. Indeed the increment shifts are still present, but the absolute value of the slope increases. Whether or not this is a cumulative effect, a type of "learning" process, or simply the enhancement of a physical pattern within an otherwise random structural condition, must still be established. Two members of our research group, Nicolas Rouleau and Trevor Carniello, have recently measured this effect in different rooms and with different pH systems when the same types of changing velocity fields were generated by arduenos and applied around toroids when similar quantities of water were located within the center.

The results from this study are directly relevant to NeuroQuantology. From some perspectives small discrete shifts in pH due to movement of protons across the neuronal plasma cell membrane *are* the primary correlate of brain activity and cognition. Proton channels which involve more ion movements than either potassium or sodium could accommodate all of the classic changes in membrane potential that are attributed to these ions. In addition, potential differences (~100 mV) that are the same order of magnitude as those of the resting membrane potential attributed to disparity of potassium charge concentration also occur at the boundary between interfacial and bulk water. Interfacial water occurs naturally along any surface area. The intrinsic structure of the water exhibits an increase in viscosity by a factor of about 10 and a layer of protons that occupies the interface between the two phases (Pollack, 2003; Del Giudice *et al.,* 2010).

Small, discrete alkaline shifts in pH juxtaposed to neuronal membrane surfaces exhibit a rapid onset following electrical stimulation and are maintained as long as the stimulating depolarizing waves continue. An increase of extracellular pH in conjunction with lowering of intracellular pH often precedes neuronal activity within the cerebral cortices and the hippocampus (Kaila and Ransom, 1968). Both are associated with the opening of H^+ channels within the membrane (Elder and Decoursey, 2001).

If our results can be generalized to the living environment within, for example, the human brain, then spontaneous or intermittent natural conditions that have resulted in excess correlations between two or more individuals who share the same space and electromagnetic configuration could produce similar effects. A simplistic application would be the following. If one of the individuals involved with the original dyad displayed changes within his or her brain that induced acidosis, such as marked physiological distress, hypoxia or the initial disequilibrium after sudden death, then there would be a complimentary shift in the second person's brain within the non-local environment in the opposite direction.

The enhanced small shift towards alkalinity would facilitate activity within the primary areas involved with thinking and memory retrieval: the cerebral cortices and hippocampal formation. The pattern of activity that had been experienced within the entangled locus, such as memories, images, or even the act of "suddenly" thinking about the other person, would be more probable. The spaces in which these hypothetical experiences would occur would be the ones within which there had been the most frequent space-time contiguity between the individuals. These areas would include bedrooms, kitchens or other loci where space-time proximity had been frequent.

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