ANPA WEST

Jounal of theWestern Regional Chapter of the Alternative Natural Philosophy Association

EDITORIAL

When a photograph develops in the darkroom, it doesn't just emerge as a face or a landscape or whatnot. Isolated details show up first, gradually finding their places in an expanding and changing gestalt. Sometimes you see them wrong, and such mistakes are hard to let go of. An emerging spot first appears as a frog on a lilly pad, and that frog is still there even after a nose and mouth appear beside it. But then all of a sudden it has become an eye, and the frog pond is a face. This kind of *development* resembles the history of quantum mechanics

Quantum mechanics began as Planck's quantum of action, a detail in atomic physics. Then came the "matter waves" of DeBroglie, the "non-commuting numbers" of Heisenberg, etc., each in its own terms a different gestalt, but together pointing to a larger gestalt involving the downfall of classical mechanics. This larger gestalt finally emerged in the late 1920's with the so-called Hilbert space formulation, which turned out to be so successful that it has become our standard theory of matter. Not everyone is happy with it, though. Standard theory is still at odds with relativity. It doesn't predict the observed "scale constants" of physics. It's best prediction of the vacuum energy is off by a facter of 10 to the 120'th power, which probably sets a Guiness record for the biggest error of all time. Is standard theory still hanging onto the frog?

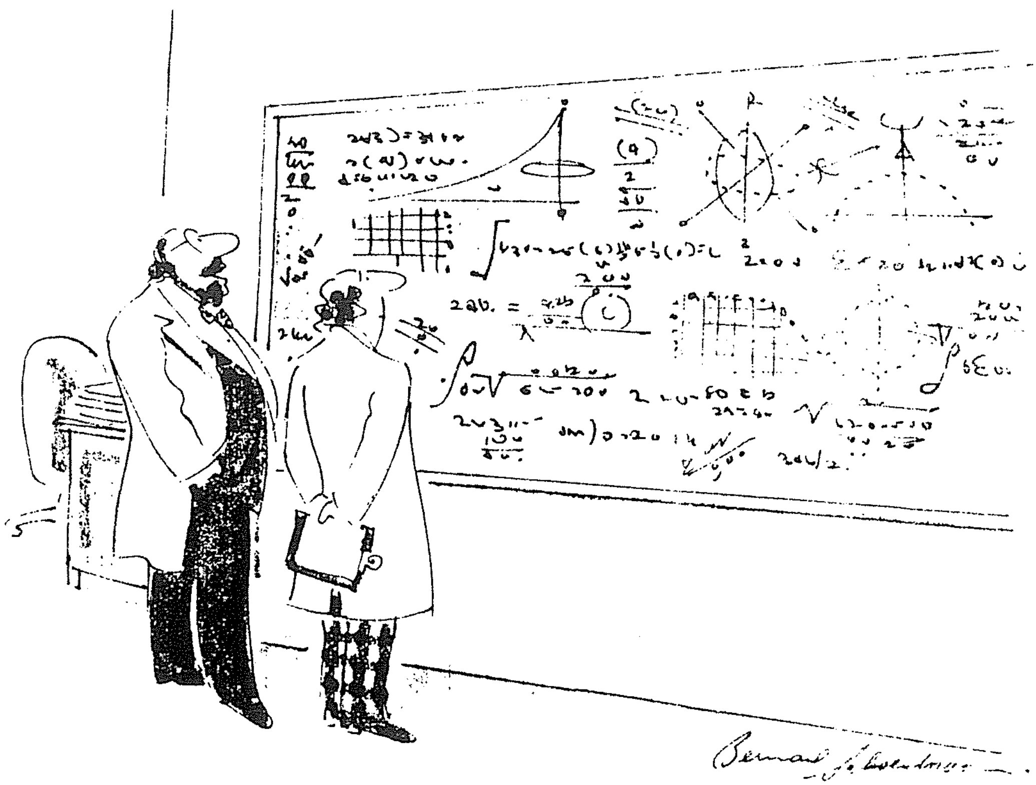
About 30 years ago, a small group of English physicists and mathematicians tried to let go of the frog. They had just discovered what they called the *combinatorial hierarchy*, a simple construction which generates the scale constants with great accuracy, and naturally concluded that this construction, even though it might conflict with standard theory, ought to be part of physics.

V.1 #1

Making it so has not proved easy, however. A number of people from around the world have joined the effort, which led to the founding by Pierre Noyes of an international organization to help keep things coordinated; this is the Alternative Natural Philosophy Association, or ANPA for short, of which ANPA West is the American branch. For a number of years ANPA has held an annual conference at King's College, Cambridge, and ANPA West has put on one or more conferences a year at Stanford, attracting more and more people each year from a variety of fields.

Planck's quantum didn't make sense as a detail of atomic theory; it had to be understood in the larger context of mechanics. Similarly, we can now see that the ANPA work, which was first conceived as a detail of physics, now really belongs in a much larger context, where it has profoundly revolutionary implications.

What is this larger context? As more people join ANPA from fields outside of physics and mathematics, this newsletter will serve as a forum for discussion. If you feel that you want to take part, let us hear from you.



"Oh, if only it were so simple."

ALTERNATIVE NATURAL PHILOSPHY ASSOCIATION

Statement of Purpose

1. The primary purpose of the Association is to consider coherent models based on a minimal number of assumptions to bring together major areas of thought and experience within a natural philosophy alternative to the prevailing scientific attitude. The combinatorial hierarchy, as such a model, will form an initial focus of our discussion.

2. This purpose will be pursued by research, conferences, publications and any other appropriate means including the foundation of subsidiary organizations and the support of individuals and groups with the same objective.

3. The association will remain open to new ideas and modes of action, however suggested, which might serve the primary purpose.

4. The Association will seek ways to use its knowledge and facilities for the benefit of humanity and will try to prevent such knowledge and facilities being used to the detriment of humanity.

ANPA WEST 4 IN REVIEW

E. D. Jones

The 4th meeting of ANPA West was held on February 20-21, 1988, at Stanford University. The conference was entitled "Quantum Concepts and Natural Philosophy".

The topics covered by the scheduled speakers included constructivist and discrete models for physics, foundational bases for space-time Einstein-Podolsky-Rosen (EPR)-type phenomena, and topology. What was thought to be plentiful discussion time was programmed into the schedule, but the interest and enthusiasm of the participants could have been good use of more.

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A Conversation with Pierre Noyes about ANPA History

Pierre Noyes is the American champion of "bit string" physics, and one of its chief architects. He received his doctorate in theoretical physics from Berkeley where his mentors were Chew, Serber and Wick, and afterwards spent a year with Peierls. He worked on nuclear forces at Rochester and then at Livermore, where he also worked on nuclear weapons; in 1969 he cancelled all his security clearances in protest against the Vietnam war. Since 1962 he has been a professor at the Stanford Linear Accelerator Center. He has published close to a hundred papers in elementary particle physics focused on strong interactions and the quantum mechanical three body problem. Since 1979 much of his effort has gone into trying to turn the combinatorial hierarchy into a comprehensive theory of the physical world.

ANPA West. In simple language, what is the combinatorial hierarchy?

Noyes. It's a mathematical procedure generating two sequences of numbers. One of these sequences specifies the scale constants of the physical universe, while the other forces the construction to terminate after four steps, showing that there are no other basic scale constants.

ANPA West. What are these scale constants?

Noyes. You might say that they fix the place of humanity in the universe. The human scale is a few feet, 100 or so pounds, and at least a second to make a decision. The mass of the universe sending light to us is 75 orders of magnitude larger than 100 pounds. The mass of the smallest particle we know to have mass is 32 orders of magnitude less than 100 pounds. The size of the smallest system we can measure is around 22 orders of magnitude smaller than a few feet. The age of the visible universe is around 15 billion years. The shortest times we can now infer are around 23 orders of magnitude less than a second. What the hierarchy is about is a way to compute these numbers which works as physics.

ANPA West. This linking of physics to the human place in the universe is very interesting, but I'm a little confused. What you just described are rough magnitudes which would seem to depend on the accident of human size, and yet what I think of as the scale constants are exact dimensionless numbers which belong, or should belong, to physical theory; could you explain a little more how these things are related?

Noyes. We are finite beings that can only spend part of our time counting such things. Most of our time we must spend filling our bellies, producing and taking care of our progeny and trying to help others to do the same. How far we can count in the time available relates our evolved structure to the rest of these ongoing enterprises.

ANPA West. When and how was the hierarchy discovered?

Noyes. It was discovered by Parker-Rhodes in 1961. The story as I recall hearing it a decade after the facts is that Ted Bastin posed the challenge to Fredrick Parker-Rhodes of how to generate a sequence with one or two small numbers, something of the order of a hundred, some very large number, and *stop.* Frederick did indeed generate the sequence $3, 10, 137, 2^{127}$ in suspiciously accurate agreement with the scale constants. This was a genuine discovery. The termination is at least as significant! There's a relatively simple rule for the sequence — the real problem is to find some "stop rule" that terminates the construction.

ANPA West. And Parker-Rhodes did that too??

Noyes. Yes, that's where the second sequence comes in; it measures the "raw material" for the first, and after four steps this runs out, so you can't keep going. By the way, he had only recently joined Bastin, Kilmister, Amson and Pask, who had started this work in the 50's.

ANPA West. When did you first become involved?

Noyes. I first heard of the hierarchy when Ted Bastin gave seminars on it at Stanford in 1971 and 1972. As an empiricist, my first reaction was that any a-priori scheme of this sort must be mystical nonsense. However, I went to the second seminar and realized that 137 was given by an old argument due to Dyson, interpreted as counting the maximum number of electron-positron pairs that could exist within their own Compton wavelength. Having reduced the argument to counting, I realized that the same argument could be applied to gravity, and then I was hooked!

ANPA West. What were the major steps in the development of the theory since then?

Noyes. Stein's random walk connection between relativity and quantum mechanics. Kilmister's scheme for generating bit strings. Gefwert's constructive philosophy. Manthey's program universe. McGoveran's ordering operator calculus, which unifies the limiting velocity of relativity with the commutation relations of quantum mechanics in what has to be a "space" of 3 dimensions. This revolutionary unification will be discussed at ANPA 10.

ANPA West. How do you see this work applying outside of physics?

Noyes. That even in a "hard science" it can be more important to understand how we think and how we communicate with each other about it than what we are thinking "about".

ANPA West. How and when did ANPA take shape as an organization?

Noyes. I had the idea of forming ANPA in 1979 when I learned from an investment counsel that many corporations with money to give away didn't know where to put it. I thought we could offer something of interest to them and of use to the world. I got Kilmister, Bastin, Parker-Rhodes and Amson to join me in making a framework. Following our first international meeting at Kilmister's "Red Tiles Cottage" in Sussex, we have held 8 annual international meetings in Cambridge and will have our tenth in August, 1988. Our initial hopes for outside funding did not materialize, but we believe we have shown that what we do is worth supporting.

ANPA West. What is the role of ANPA today?

Noyes. To pursue as best we can alternatives to establishment views about science and society that can lead to quantitative and testable predictions about the uncertain future. To find a route to a better future that can grow out of our fixed past.

WHY DISCRETE PHYSICS?

H. Pierre Noyes, SLAC

At the beginning of this century physicists started grappling with two revolutionary ideas: *quantized action* and *relativity.* Nearly a century later, there is still no consensus as to how (or even whether) they can work together to describe gravitation in a satisfactory way. Technical success in describing the physical universe has been achieved at the cost of large experimental programs and much sophisticated mathematics, but basic conceptual clarity is, for many of us, still lacking.

One of the contentions made by those who practice discrete, combinatorial physics is that the difficulties of the conventional theory stem, in large part, from the attempt to embed what are basically discrete and finite *quantum* particles in a continuous space-time background which is postulated rather than constructed. In contrast we use a fully constructive and necessarily *finitely computable* approach in which the interconnections between *events* bring us those aspects, and so far as we can see at present, *only* those aspects of "particles", "space" and "time" that are needed to explain contemporary cosmological observations and contemporary experiments in high energy particle physics.

In particular we necessarily have an event horizon, a reasonable estimate of the contemporary universal matter and radiation density — which extrapolates backward correctly to the "time" when the radiation broke away from the matter in the cosmic fireball— and a simple explanation of why there is at least ten times more "dark" than electromagnetically interacting "matter". One of the early successes of combinatorial physics (due to Amson, Bastin, Kilmister and Parker-Rhodes) was the *calculation* of an excellent approximation to the dimensionless strength of the electromagnetic interaction and its ratio the gravitational interaction in hydrogen. We also necessarily have a limiting velocity, quantized action, the correct electron-proton mass ratio, the quantum numbers of the standard model for quarks and leptons, and a start on quantitative calculations of problems in elementary particle physics. All of this is achieved by deep philosophical analysis, guided of course by contemporary experience in physics but without the use of sophisticated continuum mathematics. Instead our subtleties come from the novel and rapidly expanding group of core concepts underlying contemporary *computer science.*

Gefwert pointed out to us that any *constructive* physics must be *computable.* I went to Manthey and together we constructed *program universe* as the simplest way we could think of implementing Kilmister's ideas on *generation and discrimination.* The initial elaborations I insisted on to reach familiar physics turned out to be unnecessary; the current "stripped down" algorithm seems to give all the structure needed for modeling contemporary physics! This effort became much more systematic when we started listening to and really hearing about McGoveran's modeling methodology. He gave us immediately a *general* understanding of the limiting velocity, the reason for distant*supraluminal* correlations without signaling (Einstein-Podolsky-Rosen), and a *proof* that for large numbers of events we only need a common "3-space". Etter picked up on these ideas and derived much of the Lorentz structure. Discussions between Stein, Karmanov and myself eventually have led to a simple and fully discrete version of the Lorentz transformations of special relativity. Meanwhile, McGoveran had proved that any theory such as ours will have non-commutativity, and enabled us to identify the quantum of action. Earlier work in the quantum numbers of the standard model of quarks and leptons and a discrete scattering theory then fell into place.

The world view which emerges has something in common with the Democritean slogan "Atoms and the void suffice!" as modified by Epicurus to include the possibility of free will and exclude simplistic reductionism. We have a multiply connected sequence of synchronizable distinct events with *no* "space in between", yet satisfy the requirements of special (and perhaps general) relativity and our understanding of Bell's theorem. The stabilization of "particles" and more complex systems of connected events against a "background" of arbitrary change gives us a reasonable way of talking about the "age of the universe", our solar system and planet, paleontology.... let alone more recent "history". We might say that eventually, by chance, events and the void suffice. Yet just because we have a fixed past and uncertain future, we have no way to escape *moral* responsibility for our actions, — or our decisions not to take action. For me, it is this dimension of our alternative natural philosophy that has the deepest significance.

AN INTRODUCTION TO THE ORDERING OPERATOR CALCULUS.

BY DAVE MCGOVERAN

When Tom Etter asked me to explain briefly and non- technically the nature of the ordering operator calculus, its purpose, and my motives for developing it, I must admit that my first reaction was dismay. This is no mean task, and I will certainly fail at it. But I will attempt to make my failure a graceful one, and beg your forgiveness for any failings from grace.

The ordering operator calculus is a new mathematics which is context sensitive, process oriented, discrete, finite, and computable. It resembles multiset theory more closely than set theory, and avoids the set-theoretic paradoxes. It leads to a view of the world in which statistics apply only in the gross, where determinism is so overwhelming that we must each take responsibility for every one of our actions.

This calculus is designed to enable us to model the human experience directly. It is also designed to prevent one from ignoring essential factors such as context. It avoids the analytic regress of traditional scientific philosophy since it is constructive in nature.

My plan to develop a new kind of mathematics arose from my early experiences within the worldviews of several cultures and sub-cultures, each believing itself to be uniquely correct. I experienced the internal consistence within each of these worldviews, and also the conflicts between them - the inevitable clashes and contradictions which resulted from their contact. Nevertheless, I insisted on being an integrated individual in a single unfragmented Universe. I saw no contradiction intrinsic to nature, but only the failure of people to communicate and respect the validity of each others' experiences, beliefs and desires. For me, the greatest sorrow in our world is the inability to validate ourselves and others, the inability to accept and to respect.

In this distrust of others and doubt of self lie the roots of destruction of man and his environment. Though one can speak of this in psychological or moral terms, I see the essential problem here as a problem in 'modeling. It is the need for an extended and precise, i.e. believable, method of communication, the lack of which is felt even in present-day mathematics. The system we need must be capable of supporting multiple descriptions of a single phenomenon, including descriptions which depend on perspective or context or belief system. The system must then provide a means for "normalizing" the descriptions so that they may be combined and manipulated. The modeling which such a system supports will not be properly represented by some flat, i.e. linearized, Venn diagram of a Boolean algebra.

It should be clear that a mathematics capable of modeling the human experience should have implications for physics, or more precisely, for natural philosophy, and for other empirical sciences such as the study of natural language. Indeed, the mathematics should be able to replicate the known results in these fields and extend them with little effort. This could be considered a test of the system. If judged successful in these domains, the system might then be applied to the human problem. In time, we may be able to understand other people more precisely. And with luck, even ourselves.

As Poincare pointed out, continuum mathematics allows an infinite number of curves (read "curve" as "structure", "connection", "algorithm" etc.) though a discrete set of points in a plane. Think of these points as experiences: shall we then argue over which is the "correct curve"? Would it not be better to find some means of treating the points themselves as sufficient? It is clear that traditional mathematics does not provide this capability, let alone meet the need for modeling human experience. It is not context sensitive. It is not process-oriented. Its foundations are full of paradoxes and inconsistencies. It too often rests content with proving the "existence" of a solution without giving us any means to find it.

So, if the ordering operator calculus is my attempt to create the better system we need, what is it? On what principles is it based?

To begin with, it is built upon the idea that meaning is given to symbols by their use, and that usage is a matter of the order in which they occur. On the one hand, there must be some notion of distinguishability and indistinguishability. On the other hand, order is not taken to mean sequence - rather it is a dynamic notion, one of connectivity in many "dimensions". In the ordering operator calculus all concepts are constructed in this way. Even time and space and number arise from such considerations. Since the concepts are constructed and not postulated, the result is a computable system. And since the structure determines the meaning, the system is intrinsically context-sensitive.

At the heart of the ordering operator calculus is the modeling methodology, a triad consisting of an epistemology, a scheme of representation, and a procedure for evolving the model. I must admit that I was greatly influenced by such thinkers as C. S. Pierce, Michael Polanyi, Alfred Korzybski, and G. David McNeil in using this triad. It was slowly shaped into a dynamic entity without a proper linear or two-dimensional representation.

It is a mathematics of human experience and not of some abstract Platonic reality. Contrary to the initial reactions of some readers of the paper "Foundations of a Discrete Physics", the primary purpose of the ordering operator calculus is not to serve up traditional physics in some new form which I find more palatable. It does not take time and space as primary in any sense - and certainly not as a starting point in any of the derivations which follow in the paper.

Although computable, the ordering operator calculus is not simply binary or dyadic. On the contrary, I have attempted to make it clear that the simple discrimination scheme allowing for labeling of objects as either 0 or 1 is possible only when objects are comparable. Taking this fact into account leads to a much more interesting mathematics based in part on indistinguishability. Such indistinguishability is not like a third truth value in multi-valued logics, nor is it a measure of "non-truth" or "non-membership" like that in fuzzy logic. It is context-sensitive indistinguishability: an object may be distinguishable in one setting, indistinguishable in another. Indeed, the ordering operator calculus supports many kinds of context: linear, hierarchical, dynamic, static, network, and relational, among others that might be less familiar.

While one can obtain many of the results of the ordering operator calculus by proper application of various standard mathematical methods, the ordering operator calculus does not sow the seeds of paradox. Furthermore, the ordering operator calculus is an integrated discipline: to achieve its results without it, one must appeal to many standard and non-standard mathematical disciplines, using and interpreting them very carefully. In pointing out correspondences to traditional mathematics, I have examined concepts like "convergence" and "limit" and shown how these can be strictly redefined within the limitations of finiteness and discreteness.

I would hope that it would show the value of the ordering operator calculus if it can provide a unified mathematical foundation for reproducing many aspects of physics. As with the rest of human experience, the many aspects of physics are thought of as both firmly established, and at the same time, quite paradoxical. This being so, perhaps one can see the ordering operator calculus as impacting more directly on human life and thus recognize the participator's role in co-creating what we call "nature." It is with this vision that I have been working.

SCIENCE WITHOUT LOGIC?
or Very Elementary Physics

by Tom Etter

Though valid observers may disagree about which objects are moving and which are at rest, it goes without saying that all valid observers must have *logic* in common. That is, it went without saying until recently. The new "bit string" physics of the ANPA group has actually put the matter in doubt. How can this be? Even though two observers may express themselves in different ways, it seems obvious that if both are right, they must agree on what is consistent and what is contradictory; call this the *sanity principle*. It now appears, though, that at the deepest level of nature, it may not be Boolean logic which is invariant among valid viewpoints, but only the *symmetric difference group* of the Boolean algebra of logic. This new law might fairly be called the *insanity principle*, for if it is right, the sanity principle is wrong. Furthermore, not only does logic go out the window, but so do many common-sense concepts like part vs. whole, possible vs. actual, etc. Does this spell the end of science as we know it?

For science as we know it to come about, our monkey brains, which were not designed to contemplate abstract truth but to manipulate bananas and coconuts, had to be pressed into the service of manipulating "things" like states, times, and changes. The great biological invention which made this possible was language, specifically *written* language. Like us, the monkey experiences an open world: he feels doubt, he makes choices. But we do something utterly beyond the monkey, which is to *reify* this openness into *possibilities* or *alternatives*, which, in the form of written sentences, can be spread out in front of our very eyes just like bananas. How we form the world's openness into alternatives, and how these "pieces" of openness include or exclude one another, is the subject matter of logic, to which we shall turn in a moment. But first I want to set our inquiry in the larger context of reification, and point out how the written word, that wonderful engine of reification, can run amuck when left too much to its own devices.

In good science, theory, which is the art of reifying, is balanced by practice, which is the art of *de-reifying*. In the late Middle Ages theory had gotten out of hand; the atmosphere was thick with unattached abstractions, with flying bananas, so-to-speak. This atmosphere was greatly clarified by the later practice called empiricism. But empiricism led in turn to better theories, and theory, emboldened by its successes, has again bid to capture and hold all of reality in its eternal grip. The new scholasticism is well upon us.

A century and a half ago Hegel wrote: "The main lesson of Empiricism is that man must see for himself and feel himself present in every fact of knowledge which he has to accept." Take a simple fact: "The cup is on the left side of the table." How do I see for myself and feel myself present in this fact? I have to *back away* from the written fact through a series of steps which could go like this:

"The cup is on the left side of the table."
"This is on the left side of the table."
"This is on the left of that".
"This . . . that".
" . . . ".

In backing away from the written sentence I approach the actual table and cup, the two objects which correspond to "this" and "that". But now consider the fact "If the cup is on the left, it can't be on the right". How do I feel myself present in this fact? Here's a plausible sequence:

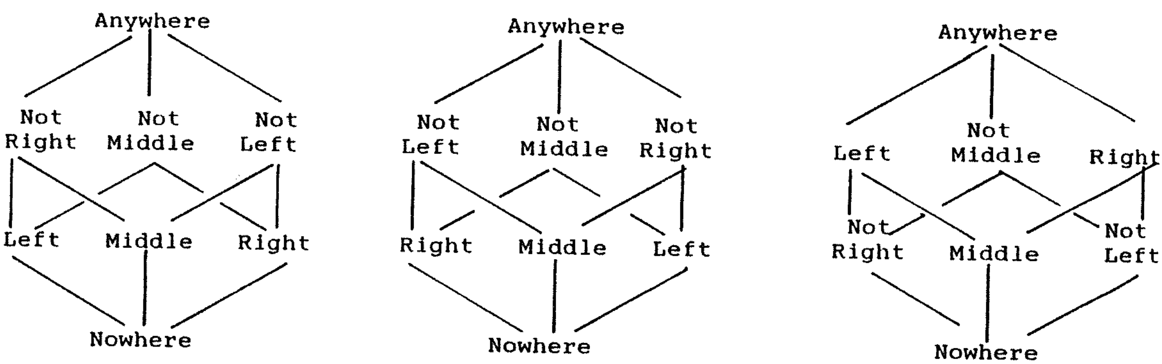
"If the cup is this, it isn't that".
"This contradicts that".
"This . . . that".
". . .".

But now, having moved away from words, what have I moved towards? What are this and that? Surely they are not objects; rather they are the stage just before the *dereifying* of certain "objects". When reified such objects are called alternatives, or propositions, or cases, but without reification, there simply aren't any such things. The first kind of fact seems to belong to the cup and the table themselves, but the second is clearly inseparable from the act of reification by which its objects are created.

Hegel goes on to write: " .. But Empiricism labors under a delusion, if it supposes that, while analyzing its objects, it leaves them as they were." Our reluctance to give up the objectivity of logic comes from our delusion that those objects we call alternatives just sit somewhere like cups on the table, waiting to be seen, and that the logic of our sentences describes their pre-existing arrangement. Indeed, sentences are like cups on the table; they do sit on the page waiting to be read. But it is the sentences that fix, mold, indeed create, the things called alternatives; it requires a particular sentence to make the openness of experience into a particular *opening*.

Understood in this light, the new "illogic" is not so threatening as it first appeared to be. It does indeed provide some surprises; there are more ways to make openings than we had realized. But "illogic" doesn't threaten to invade the world, since logic never belonged to the world in the first place.

To understand what logic does belong to, let's assume the cup is either left, right, or middle, and make a list of everything that can be said about the cup's place. There are eight such statements: "It's left", "It's right", "It's middle", "It's not left", "It's not right", "It's not middle", "It's nowhere", "It's anywhere". Each is a distinctive piece of openness. Some of these pieces overlap, some exclude each other, some are more open than others. Such relationships make up what is called Boolean algebra, which we can represent by the edges and vertices of a cube, called the *Boolean cube*.



From this side of table   from other side   far out

When I move around the table, I carry this list with me, though its items exchange roles as pieces of openness. Such exchanges, which we can represent by *transformations* of the cube, have always been thought to preserve the Boolean operators NOT and OR (all other Boolean operators can be defined in terms of these). Note that this is true when I change sides of the table. Bit-string physics introduces an essentially new kind of transformation like that going to "far out" above. These don't preserve OR, but do preserve what will be called *prelogic*, which is like logic with OR replaced by OREX, i.e., *exclusive or*.

Define *cases* as mutually exclusive alternatives. Case counts are basic to probability theory; recall that Pascal defined probability as the number of favorable cases divided by the total number of cases. It turns out that in the algebraic analysis of relational composition, there are certain very general theorems about case counts which have exactly the same form as the state-transformation rules of quantum mechanics in terms of density matrices. Quantum theory could thus be regarded as a branch of relation theory except for one little thing: in quantum theory, cases counts go negative!

To make a long story short, although case counts can't go negative in logic, they can in prelogic, and in fact they must, in order to avoid a strong and universal non-locality which would make it impossible to isolate anything; without negative cases you could never speak of *this* rather than *that*. It turns out that this new case count, which can only be defined in one way, is just what is needed for the above theorems about relations to actually give quantum theory. Relation theory in prelogic extends quantum-like ideas to all of mathematics. It provides the wider setting for quantum theory proper that physicists have looked for in vain among traditional ideas about matter; it finally integrates the quantum with the classical. In this new setting the old quantum puzzles like that of the collapse of the wavefront no longer occur.

The new theory based on pre-logic is full of promise for science as we know it, but I believe that its real promise is in what it may lead us to develop as the new practice. Empiricism, which began as an antidote to theory, has come to have its own strongly theoretical side known as *scientific method*. Like classical physics, scientific method is a very good theory within its proper domain. But its classical rules for testing hypotheses etc., which may once have seemed self-evident, can now be seen to rest on our universal *projection* of the Boolean structure of written language. This projection becomes increasingly suspect as we move away from the realm of everyday objects that can be manipulated like linguistic tokens. By the time we get to electrons it has become a quaint myth; it's like describing the tiny winged horses that pull the electrons around in their orbits.

But we don't have to go nearly that far to leave the realm of objects-at-hand. Indeed, the manipulation of objects makes up only a small part of experience, which is also a matter of wanting, hoping, trying, feeling, believing, judging etc. Even in the domain of distinct beings, objects-at-hand are only the bit players; *it* and *them* yield center stage to the main characters, who go by the names of *you* and *I* and *him* and *her* and *us*. In forcing us to give up the Boolean analysis of alternatives, the new theory forces us to rethink empiricism, to once again ask what is involved in moving *in person* from the theory on the page to the fact in which I am present. The hope is that this time we'll come up with an empiricism that is more adequate to experience.

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Jounal of theWestern Regional Chapter of the Alternative Natural Philosophy Association

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Next Conference:

ANPA West 5

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Ventura Hall, Stanford University

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There was a flux of people arriving and leaving the conference throughout the weekend, with a mean of about 30. The fields of interest represented by the participants included physics, mathematics, computer science, philosophy, psychology, and biology. It was especially gratifying to see many new faces, including a goodly number of graduate students.

One of the most enjoyable aspects of the conference, in addition to its intellectual stimulation and rigor, was the spontaneous comraderie and sharing among the attendees, including the newcomers. For example, coffee breaks were usually more occupied with impromptu and highly animated blackboard discussions than with coffee drinking.

Several people suggested that ANPA West continue to expand its base of interests to other fields, and to include presentations on a more diverse mixture of topics in future meetings.