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HOW HIGH IS UP? THE NEW WORLD OF FREDERICK KANTOR

Let us consider a Box B, inhabited by an observer.

As recently as thirty years ago, it still seemed perfectly normal for an investigation in physics to begin with that box: a mind-experiment that involved, mostly, a good deal of thought, a supply of pens, ink and paper, and possibly a slide rule. Dr. Frederick W. Kantor (whose book-jacket biography lists him as "inventor and physicist," and who holds a widely scattered sheaf of patents in a variety of surprising fields), can be credited with quite a list of good deeds resulting from his agreement to write down some of his recent inquiries and their results for John Wiley & Sons (**Information Mechanics,** published last year)—but, just possibly, the most important immediate result is that he has gone out and brought back that Box B.

It is a depressingly common notion lately that, if you want to do any physics, you require urgently a quarter of a million dollars in the way of grants, a sprinkling of large accelerators of various sorts, a few cloud chambers (now bubble-chambers, and by next year the things may be filled with yarrow stalks), and virtually any amount of expensive computer time and attention. *Information Mechancis* is the single most important step forward in physics since cybernetics, and arguably since Planck introduced us all to the quantum: it will take a little time to get thoroughly heard of, but it is getting a first trickle of astonished notice already. Wait around for the flood.

And, in order to do his physics—in order to come up with the material in *Information Mechanics*—Dr. Kantor used a great many ballpoint pens, several reams of paper, and (our handy

by Laurence M. Janifer

substitute for the slide rule) a pocket calculator. We are informed on page 149 that the calculator was Hewlett-Packard's model 65; there's a later reference to the model 67, and though the 65, I'm told, was the main instrument on hand, a few others seem to have been used—whatever, within the limits of necessity, was handy at the time. The list price of the 65 is so large, compared with the price of pens and paper, that it almost looks self-indulgent. But leave it in—one HP-65—and add everything up: you get a final cost for this work of well under $1,000.

That is, of course, $1,000 and somewhere between fifteen and thirty years of intensely careful thought. Dr. Kantor, who is thirty-five, says somewhere in the book that he began thinking about the problems with which *Information Mechanics* deals when he was about five.

And the first look into this book is an outrageous shock. Dr. Kantor has been the center of a few notable shock waves: it was the Nobel laureate (1955) Dr. Polykarp Kusch, in the days when Dr. Kantor was prowling the halls of Columbia University in search of his PhD, who told him: "you have your own way of doing physics." Long pause. "It seems to work." Dr. Kusch undoubtedly remembers the pre-quarter-of-a-million-dollar days; he probably didn't expect them to return in any large hurry, especially in the person of a large, bearded guitarist with a taste for strenuous wilderness hiking, and a disconcerting habit of showing up, no matter what the occasion, in regulation hiking gear, complete with knapsack. Even before you start prying away at the text, you have

the jacket blurb to deal with, and the jacket blurb says, in its opening paragraph, that the book states:

". . . a basic theory that concisely subsumes and is independent of previous approaches. It offers fundamental new concepts for physics, astronomy, cosmology, and mathematics; a foundation for future philosophic investigations of meaning, objective reality, mind, linquistics; and new technologies."

Very well: you start girding up any and all available loins to doubt this. And you notice, damn it, that the publisher is not some "Inspirational Nonsense" house out on the West Coast, nor a simple vanity press, nor, for that matter, J. B. Lippincott. And Wiley, flatly, does not go off that sort of deep end. This publishing house has a higher, and more conservative, reputation than any other I am aware of in this country (or most others, for that matter); the claims made about a hard-science book, by this publisher, have about the effect of a rave review of somebody's latest porno sleaze, signed by Anita Bryant.

In fact, Dr. Kantor, who writes with a sort of uncontrollable reasonableness, and who prefers "it would seem" where anybody else you know would use "it is a definite, provable fact that," objected to the blurb. He was told that the book belonged to him, but the jacket was the business of John Wiley and his sons—and that, in any case, the statements made were perfectly justified by the book—might, in fact, even be understatements. Dr. Kantor is still uncomfortable with the blurb. His own preface describes *Information Mechanics* as providing "much of the conceptual basis and

formal methods to date of what appears so far to be an interesting new path of inquiry." That, offhand, strikes me as a major contender for Understatement of the Century.

The trouble is, of course, that the great width both of theory and possible application makes *Information Mechanics* a little hard to describe. Maybe you ought to stop here, and go out and buy the thing. But you may not have the math, the background, or the $20 at hand at the moment; let me try to quarry out a few samples.

The central idea seems very simple. It is possible to express any transaction of any kind as an encoding and decoding of information. Billiard ball A is struck by a cue, or whatever's handy, and smacks into billiard ball B: the information (which B is equipped by its own physical properties to decode and act on) conveyed is: "Move in this plane, in this direction, at this speed, at this time—and so on."

All right so far, but an urgent footnote has to be shoved in here: you're as likely as I was to grab at an easy analogy, and think of frictional losses and so forth as taking the place of "noise" in information theory, but that isn't the world in which Dr. Kantor is operating. The information itself—the "code" which is, in fact, billiard ball A—is wholly conserved: there is no loss. All information is conserved—which is part of what Dr. Kantor treats as a three-part statement, but which can be put into a single postulate: "Information is conserved, communicable, and finitely accessible."

That is the only postulate involved. The theoretical basis for it is quite as good as the basis for various other conservation laws, and the practical,

predictable results are a good deal more exact than people are used to. Dr. Kantor seems to have got a physical description of the world down to seven words and four numerical quantities—from which everything else is in principle derivable.

The quantities are fascinating, since all of them can be taken as 1, if that's handy, except the first. They are: I_U, the total amount of information in universe U, measured in bits, and (measured in any terms: Dr. Kantor isn't picky, since, as I say, these three can each be reduced to 1), R_U, the linear size of U, which is useful for calibrating length units; c, the linear coefficient of the "propagative local velocity" of light, useful for calibrating time units in terms of R_U; and E_1, the energy per information-bit, useful in a world containing instruments calibrated in energy or mass units.

That "propagative *local* velocity" up there is just as startling as it looks. I asked Dr. Kantor whether he'd meant to imply that the velocity of light might not be *semper et ubique*, a constant, and his reply was as odd as the book: "Not quite: the question is whether this communication process is necessarily characterizable by 'velocity'."

All *right*. If you are beginning to feel that all of this is a giant put-on, a Velikovskian whirligig, or simply this writer's overreaction to a single book, try the following: Wiley attests to every fact in its blurb, and the book justifies it all quite perfectly:

All of the following are derived quantities, given those seven words and four numbers: the gravitational constant G, Planck's constant, Hubble's constant, weak interaction data,

Maxwell's (source-free) equations—as stated for a vacuum: distortions due to other conditions are simple enough to work with—the "fine structure constant," and what Dr. Kantor calls "approximate" values for what appear to be, so far, the rest masses of the sixteen lightest "elementary particles." What appears to be strong interaction is also derivable (and is derived), and Dr. Kantor is now at work on some of the heavier "elementary particles."

Also simply derivable from his four quantities and seven words are special relativity and quantum mechanics—and a means of getting them to shake hands.

A great deal has changed, if *Information Mechanics* makes sense. (And it does seem to: see Table 3, with explanatory notes, on p. 268, which gives a large sample of Dr. Kantor's calculated results as compared with the previously reported results. You might note that what Dr. Kantor accepts as a discrepancy—what he will call "approximate"—is perhaps five parts per million; what most reports will accept is somewhere near ten parts per thousand. Explanations of column notation are provided with the table. Please note the odd typo: columns 7 and 8, in row 2-3, should carry the footnote (d). There don't seem to be many typos, all told, but a few will always creep in: note, for instance, that on page 260 r [in the main figure, not the exponent] seems to have crept into 9., and r^2 [main figure again] has horned into 10.: both should be tossed out.)

A great change: well, it's the difference between Ptolemaic and Copernican astronomy. It does take awhile to get used to this new Copernican system (Dr. Kantor has invented his own acronyms, here and there his own sort of—quite legitimate—math, and throughout his own English, which is a valiant attempt to write out in words a good many things for which the mathematics does not yet exist)—but once you get used to it, the ease and simplicity with which you can handle a variety of problems is startling.

It is perfectly possible to describe any astronomical event in Ptolemaic terms. It's also lots of fun, if you have a great deal of time on your hands and a fairly resourceful computer. But the stuff you come out with is so incredibly complex that it is almost impossible to think about any astronomical fact in relation to any other one.

The change to Copernican thinking made a lot more thinking possible. *Information Mechanics* does that: if change-of-position, change-of-temperature and change-of-intention (due to propaganda, learning, hypnotism or what-have-you) are all thought of as information transfers—usually only the last is—then all can be handled by the same set of tools. It becomes possible to handle physics with tools based on information concepts, and once you begin you seem to come up with a good many helpful notions. For instance:

What is "position"? Dr. Kantor asks that one at the end of his preface; he asks: "How high is up?" rather late in the book and of course answers it properly: R_U. Does change-of-position involve velocity? Does it involve passing through a number of intermediate "positions" on the way, and does change-of-position involve any time whatever? Don't answer in any great

hurry: remember the tunnel diode, in which an electron appears here, and then over there, without having "crossed intervening space," if the phrase in quotes has any meaning.

What is "mass"? What is "gravity"? "Mass" seems to be a store of finitely many bits of information, related to other such stores; "gravity" looks like a description of what happens to two or more such stores as they exchange or otherwise transfer definable bits of information. An observer is on planet A. The closer planet A comes to, say, moon B, the less the store of possible position information moon B can have: out of all the places in the universe in which it might be, or among which parts of it might be scattered, it is only in a subset of such places—those inside a radius which shrinks as moon B approaches planet A and our observer. This loss of position-information— this increased specificity—appears to be what we mean both by "gravity" and by "curvature of space."

What is an "elementary particle"? Dr. Kantor's most elegant mathematics, in my view, is devoted to showing that *any* elementary particle can be reduced, for all practical and theoretical purposes, to photon(s): any additional qualities such as mass, charge, spin and so on are added information, coded in describable ways.

The bane of physics for over a century, "action at a distance," begins to dissolve: in Dr. Kantor's universe of information-bits, "distance" has no inherent meaning whatever (remember the tunnel diode), and "action" becomes the encoding and decoding of information, a process more primitive than time or space—from which the concepts of time and space, in fact, seem to flow.

I have two pieces of advice for the curious. First, buy the book: nothing you have experienced will do quite so much to order your mind regarding the physical universe.

Second: use this article as an introduction to Dr. Kantor's new and startling world. By all means begin with his preface—but skip all of his Section 1 and go straight to Section 2. Section 1 is meant as an overview of material to be gone through, more and more rigorously, later on, but it is simple hell to hack through without the background of the rest of the book, and this piece may serve as an amateur overview for awhile. If you need Section 1 later on, it'll be there; but start with Section 2.

I promise you, without reservation, that Dr. Kantor can give you a totally new view of physics and our universe, and that he can back that view with the most careful mathematics I have seen in some while, and with predictions that are accurate enough to raise the hair, if there is any, on the head of your average wandering muon.

And that promise is why I've taken Analog's space, and your time, to talk about *Information Mechanics*. There are quibbles I have with the book (a very late section on free will, of all things, seems to me to miss the point so grandly as to be available for a point-missing award; I doubt his flat statement that "black holes" are not possible in our universe, though I can't argue with the math), but the quibbles are awfully small. And the book, by comparison with anything you've looked into lately, is awfully god damned large. ■