

# Notes on a Herbacious Reality

Christopher A. Fuchs

Department of Physics, University of Massachusetts Boston  
100 Morrissey Boulevard, Boston MA 02125, USA

Reality, we naturally think, stands ready-made and complete, and our intellects supervene with the one simple duty of describing it as it is already. But may not our decisions and actions be themselves important additions to reality? And may not previous reality itself be there, far less for the purpose of reappearing unaltered in our knowledge, than for the very purpose of stimulating us to such additions as shall enhance the universe's total value? No one can deny that such a role would add both to our dignity and to our responsibility as thinkers. To some of us it proves a most inspiring notion.

The import of the difference between QBism and the Everettian interpretation of quantum mechanics is thus now in sight throughout its whole extent. The essential contrast is that *for the Everettians reality is ready-made and complete from all eternity, while for QBism it is still in the making, and awaits part of its complexion from the future.* On the one side the universe is absolutely secure, on the other it is still pursuing its adventures.

We have got into rather deep water with this view, and it is no wonder that misunderstanding gathers round it. The QBist view of 'reality,' as something resisting, yet malleable, which controls our thinking as an energy that must be taken account of is evidently a difficult one to introduce to novices. Still, a few people have always felt the idea in their bones, even if they could not quite articulate it. Among them is our dear Herb, and that is why we love him.

— the ghost of William James

## Introduction

To the best of my recollection, I first met Herb Bernstein between June 26 and July 5, 1995 at the Villa Gualino in Turin, Italy; it was at one of those wonderful yearly meetings in the early days of quantum information sponsored by the Institute for Scientific Interchange. I wish I had a record of the exact date of our first contact, but one conversation (late night July 5) for sure stands out and was recorded in a letter to my wife, Kiki. Herb and I were both in the computer room at the Villa Gualino—that's where everyone wrote their emails in those days. (Who had a laptop or even an ethernet link in their room back then?) I asked Herb if he might "have a postdoc for me." He replied, "What kind of a person are you looking for, and when would you want them to start?" I was floored! I explained that I wasn't a professor, but rather a graduate student looking for *my own* first postdoctoral position. Herb has always been a

flatterer. Indeed, that got our conversation going. But soon it turned to quantum foundational matters, and *that* conversation hasn't ended to this day.

As always with me, verbal conversation turned into extended emails, and emails with any content on the quantum turned into entries in one of my samizdats. That night, I learned that Herb and I were kindred spirits in the quest for ... the quest for ... well, something. We couldn't quite put our fingers on it, but we both felt we could see the same thing in the distance: A role for mankind in the shaping of reality itself. As John Wheeler put it, "In some strange sense, this is a participatory universe."

To celebrate Herb's 80<sup>th</sup> birthday, I collect here those emails that have already made their way into my two posted samizdats, *Notes on a Paulian Idea* [arXiv:quant-ph/0105039](https://arxiv.org/abs/quant-ph/0105039) (later published by Cambridge University Press as *Coming of Age with Quantum Information*) and *My Struggles with the Block Universe* [arXiv:1405.2390](https://arxiv.org/abs/1405.2390). I end with a small envoi.

The art form called QBism has come a long way since those early days of writing to Herb. Both for him and those readers who would like to see its state of development at the time of this writing, I might recommend:

- "QBism: Quantum Theory as a Hero's Handbook" [arXiv:1612.07308](https://arxiv.org/abs/1612.07308)
- "On Participatory Realism" [arXiv:1601.04360](https://arxiv.org/abs/1601.04360)
- "Notwithstanding Bohr, the Reasons for QBism" [arXiv:1705.03483](https://arxiv.org/abs/1705.03483)
- "QBism, Where Next?" [arXiv:2303.01446](https://arxiv.org/abs/2303.01446)

But for the here and now, we look back to the there and then.

## 25 December 1996, "Reality Steaks"

Holiday cheers! I'm sitting in Geneva, connected to my machine at Caltech, thinking about an old fart in Massachusetts. I was just reading an article (in the *New Yorker*) about Woody Allen and came across the most wonderful quote: "I hate reality, but, you know, where else can you get a good steak dinner?" Like it? Quantum mechanics everywhere you turn.

## 17 February 1997, "Prophetic Herberts"

This is the second time you've intrigued me with a phrase or two: I'm not letting you off the hook this time. Please explain in more detail what you mean by the following. The first quote comes from 25 December 1996:

**Herbal Tee 1:** *Actually that Austrian reaction to enhancing classical communication was probably part of a reality-loving or at least a quantum-preferring inclination which is something beneficial to the reality-seekers amongst us—if everyone were so crazed about measurement and what-all, Charlie would never have figured out that it wasn't the knowing of an answer which introduced the irreversibility; it was the erasure of the "garbage" produced in the calculation. And without all the fuss over reversible classical computation, we wouldn't have had so much fun with quantum comp.*

The second quote comes from 12 February 1997:

**Herbal Tee 2:** *I was impressed similarly by Charlie's hint that thinking beyond the "big deal" everyone since Szilard seemed to make of measurements was crucial to his realization that the entropy generated by Maxwell's demon for a 1-molecule gas came from forgetting which side of the door it was on. The entropy generation didn't come in measuring which side of the barrier contained the molecule, and memory of the side would make the process reversible, etc. etc. etc.*

Are you saying that Charlie's solution of the "Maxwell Demon Paradox" might have something to say about the solution to the "Quantum Measurement Paradox"? If so, let me know what you're thinking—I'm intrigued.

### **Herb's Reply**

I am saying that I suspect Charlie was UNimpressed by the notion that something very special occurs in the act of measurement *per se* – and I do mean UN. He was able to see past where Szilard went unlike many other people, because he didn't believe the measurement automatically meant irreversibility. And he analyzed what it would take to make the "measurement" i.e. determination of which side of the barrier the molecule was on recoverable; indeed he pushed the analysis until he could say for sure the state was unrecoverable, and discovered that the issue was getting rid of the garbage that accumulates in a series of measurements, like the garbage that accumulates during a long calculation.

So the moral of this long-winded story is that we who are impressed with the quantum requirement to make a decision somewhere about what it means to do certain interactions, i.e. those of us who remain Bohrian enough to believe a phenomenon is not a piece of reality until it is a registered phenomenon, must be cautious. We admit it is an assumption that this implies reality creation IS a part of scientific inquiry and we examine this—and others—of our assumptions always; by doing so we will also clarify when they are wrong or misleading and when they just slightly misdirect our gaze.

In short there is a rather complex and muddled connection between C. Bennett's "Maxwell's Demon" work and our continuing investigation of the need and privilege to CREATE the reality we study in quantum mechanical situations of all kinds.

### **23 February 1997, "Herbertic Realities"**

Thanks for your comments on Charlie and demons; I understand you better now. I especially liked your comment: "... indeed he pushed the analysis until he could say for sure the state was unrecoverable, and discovered that the issue was getting rid of the garbage ..." I'm not sure what I want to say about that, but I want to say something—I just love the intent there. What is the difference between getting rid of information by dumping it into the unknown and getting rid of it by spreading the information to an uncontrollable group of free-willed communicators. Give me a few days to try to formalize it all.

### **27 March 1997, "Consistent Herb"**

In the next two mailings, I'll send you the correspondence I had with Griffiths on "consistent histories." (The first is my writing, the second is his.) I would still like to construct a detailed reply concerning this analogy he likes to draw between "frames of reference" in special relativity and "Boolean frameworks" within his version of quantum mechanics. I don't like the analogy

and I think it is misleading precisely because quantum mechanical probabilities are not about real existent things that are or are not the case—as best I can tell, they are solely about contingencies. Alas though, my life and time are not infinite. (I’ll get to it eventually.)

I had a very nice conversation with Charlie on the drive back to Wendell from your house, that, I think, has allowed me to sharpen what I think about things in quantum mechanics. In particular, I would like to work on a point of view that substitutes in place of the “Church of the Larger Hilbert Space,” something along the lines of “Church of the Big-Enough Hilbert Space.” However, it’ll require some writing for me to get it down coherently. I’ll try to combine it with my thoughts on Mermin.

Anyway, I had a really great time last week at your place. This quantum mechanics business is so wonderful, it’s almost no surprise we can entertain ourselves with that, a few fried potatoes, and not much more! Greetings to Mary and the family.

## 29 March 1997, “More Reality”

Did you, by chance, read the article titled “Get Unreal” in the March 17th *New Yorker*? In case you didn’t, I’ll share with you my favorite quotes from it (that I want to tabulate anyway . . . I love to use friends as good excuses).

“People experimenting with high-definition television, or HDTV . . . report that the resolution of the image is such that details invisible on ordinary television screens, like scuff marks on the anchorperson’s desk . . . leap out at you on HDTV. The Times predicted the other day that television production designers, formerly accustomed to tacking a studio set together out of plywood and duct tape, will have to start building the real thing. On standard television, mahogany stain looks like mahogany. On HDTV, it looks like stain. To maintain a realistic image, in other words, television will have to construct a better reality. The simulation is getting ahead of the simulated.”

“In the case of the music industry, the rationale for persuading people to ditch their phonographs and LPs and replace them with CD equipment was that digital CD sound was more lifelike than the analog sound of the old LPs. Actually there was nothing wrong with analog sound. The ear learned to block out the occasional hiss and pop, and found the result adequately lifelike. You do not, after all, listen to live music in a soundproof chamber. . . . Once CDs became the standard, though, *they* became ‘lifelike,’ and analog recordings started sounding wobbly and staticky.”

“Human kind cannot bear very much reality,” says the little bird in T. S. Eliot’s “Four Quartets.”

“The craving for more and more realistic representations of reality is at bottom an aesthetic craving, and one that people are perfectly capable of indulging purely for its own sake—an indulgence beautifully illustrated by the tremendous expense and effort being invested in getting a computer image to look and function exactly like a piece of paper. But the effort to satisfy such cravings kind of misses the point of what the true pleasure of representation is. The true pleasure of a representation does not come from its indistinguishability from the real thing. It comes from its distinguishability. An Elvis impersonator gives pleasure precisely because he’s not Elvis, and it is crucial to the effect that we never forget he’s not.”

## 07 April 1997, “Howling Quanta”

“The universe is a thing of dream  
substance naught & Keystone void  
vibrations of symmetry Yes No  
Foundation of Gold Element Atom  
all the way down to the first Wave  
making opposite Nothing a mirror  
which begat a wave of Ladies marrying  
waves of Gentlemen till I was born in 1926  
in Newark, New Jersey under the sign of  
sweet Gemini”

— *Allen Ginsberg*

I guess you’ve heard that Mr. Ginsberg passed on? Maybe that makes today the appropriate day for writing this note. You ask, why are we (you and I) so in sync on this issue of reality creation? I suspect it’s most likely a chance fluctuation ... or a “selection effect”—why else would *we* end up working on quantum information?

Of course, the 60’s did play a part, apparently for both of us. But for me, I suspect, in a very different way than for you. I was a kid in south Texas in the late sixties, very far from hippiedom. My sixties were filled with conservative democrats, cowboys, oil fields, and an occasional trip to the big city of Houston—there was no great connection to a world of ideals. I think surreality slipped into me from a much smaller world of turmoil. Somehow in the early years I gained the habit of making things look magical to myself. In my head, the most mundane objects became spaceships. For years I imagined that an imaginary friend and I were in search of the “end of space.” The fantasy mostly consisted of us travelling outward, and building ever faster vehicles as we were doing so. There was no time to waste!

Did this shape my thoughts on quantum mechanics and, in particular, make me more receptive to it as an almost mystical structure? I think so. [I’ll include a couple of passages that build some imagery about it. The first is a little poem that came to me in the DFW airport about a month or two ago:]

The ghost of my father sat in front of me  
sprinkling salt into its beer.  
The floor, wooden and sole soaked slick  
I could just push my feet and rub my fingers.  
“Give me more life,” I whispered.

I wanted to touch the flakes of rust  
on the cooler, mingled with sweat.  
Bottle caps everywhere; it didn’t understand  
the boredom.  
My only sound was that of a screen door.  
“My son will be a professor of physics in three years.”

[The second is something I wrote sometime in 1993; I’ll place it below.]

You asked me if I have ever thought about the immense responsibility entailed by the possibility of reality creation. Yes I have, but never in any very organized fashion. In relation to this, my thoughts keep coming back mostly to the Holocaust, but also to instances of self-devastation like with the Jim Jones gang in Guiana. I think it was just this sort of thing

that Einstein feared most about quantum mechanics: that reality ... and consequently right and wrong(!) ... might even be creations of the participants. (By the way, you can find an expression of this in the bad “free form” poetry below.) I understand the fear of E ... but, also, I don’t know how to get around it.

Everyday Albuquerque reveals. Hollywood knew the quantum; giant scorpions in a desert. Fluid reality. The shape of entertainment. Notorious youth making out in cars; paying no attention to surreality itself. Paying no attention to the mystery and depth. There is a faint image that lives within me; sometimes it speaks. And sometimes I know it contains the room across the hall. Sometimes I know the room across the hall was foreseen somewhere. Something is built in. Somehow it registers; it picks out a unique reality. The tome of this world. Einstein must have foreseen the evil in our dear quantum. I don’t envy the pain; the blood is so very frightening. No evil in A-bomb, but the evil of no image; the evil of no substrate; the burning people in Waco; my father tied to a bed. The poor roaming wisdom of E. On a movie set; money to be gained. Sexuality in images for money. This I see in THE Friday night. And this gnaws; frightens; feeds; asks for stability. An image that asks for expression. But with mysticism that can’t be controlled. In paint delicately placed on a manifold. Spacetime is there somewhere in all the projects asking for flight. I see jeeps with water canisters on the back. I see a snake near a water faucet. I see a child giving up. Emptiness in a world nonexistent. Emptiness as definition; and emptiness for all its sake. There was an old stump with a few nails of differing size driven into it; it was a console and control. There were mysteries at the grass and at the curb. Tall grass; dreams of soldiers; boys dying across the world. The fence near the control protected; gave barrier. The nurturer of surreality was somewhere there too. Orwell came to visit somewhere in those dreams, at the control and at the creek. He gave me a gun from afar, and a yellow bicycle. And with the gun I learned to count. And with the bicycle I learned fear and dread. Dreams of reason in this reasoned state. Orwell saw my youth from afar; and then gave his mind away. His novel is my world; the scaffold on which to build what can be built. Orwell shaved his head and came to visit when I was sick. The tears came when they said “love.” Albuquerque made its presence known somewhere in Texas long ago. The Germanic blood in my veins saw it then. The world was portended.

— *CAF in a weird mood, 1993*

## 05 June 1997, “Dreams of a More Ethereal Quantum”

I thought I’d just say hi and let you know that I’ve been visiting “reality town” for the last couple days. I’ve finally (after all this time!) really started thinking about Mermin’s Ithaca Interpretation. (He’s now jokingly calling it the “75 Hickory Road Interpretation” since not everyone else in Ithaca is so enthused about it. Charlie B. asked him if everyone in his family was actually in agreement!) Much of this was spurred by my meeting him last week in Montréal.

I’m not sure what to make of it. I guess I think it’s all too vague for me to have any strong opinion one way or the other yet. This has been helped out by my impression that Mermin himself doesn’t really know what he’s trying to get after yet. The key ideas seem to be:

1) The density operator for a “system” is a convenient icon/shorthand for all possible correlations between all possible “subsystems.” However, the quotation marks in the preceding sentence are absolutely necessary; for it is the correlations themselves and not the individual properties of the systems that form the “elements of reality.”

2) The real interpretational problems in quantum theory are really in understanding a proper notion of “objective probability.” The only hint we have for understanding such a notion presently is the quantum theory itself—the very thing we were working hard to interpret in the first place. [This attitude, by the way, traces back to at least his 1983 essay “The Great Quantum Muddle” critiquing Popper’s books, where he writes, “. . . what is most marvelously intricate and subtle in the behavior is just a mystery and a horror to be dispelled by some clear thinking about [[objective]] probability.”]

You can see from Appendix B in the paper (on the Hardy Paradox) that he wants to tie these two ideas together very closely. Namely that the flavor of objective probability is that some conditional probabilities cannot be properly formed. However, I don’t see really how that is so distinct from Copenhagen: “unperformed measurements have no outcome.” What is it that’s really new here? (. . . beside the over-use of the phrase “objective probability”?) What am I missing? I guess the idea is to use the standard interpretation to figure out which (conditional) probability statements are meaningless and then abstract/bootstrap these properties into the new interpretation.

I just looked back at the last note you wrote me on this subject. I’m not sure I can answer your questions. Have you thought about them more? The best I can say is that I don’t think he intended the density matrix as the end-all and be-all of everything . . . only of the correlations between the subsystems which it encompasses. The density operator itself says nothing of the how the overall system is correlated to the rest of the world (which I think is what your example was getting at). Apparently the only thing that one can glean . . . or, at least this is what I think he’d say . . . is that if the state is not pure then the system of interest is definitely correlated to something without (i.e., external to it).

I’ll keep thinking about these things. Within a day or two I’ll be composing a note to Mermin on “objective probabilities”; I’ll cc: you something when it’s written.

In the mean time, I place below—for your amusement—a note I just wrote Asher. I think it contains the most succinct statement I’ve written yet concerning the program of “*Mechanica quantica ex mente orta lex est.*”

## 04 August 1997, “The Nielsbohricon”

Anyway, I was sitting here feeling low about not having yet finished the long note on quantum probabilities that I am in the process of writing you. And I was thinking about your Niels Bohr “roundtable” plans. You guys at the liberal artsy places get to do such fun things! In case it’s of any use to you, below I give a small offering of a “starting point” for your fun and games: these are some of the things that I myself have perused and found useful. (The list has no pretension of being complete.)

I think these things are useful to read . . . not because they’ll paint a consistent picture of what Bohr thought (I doubt there’s one to be painted) . . . but because they give a good hint of all the issues that our own project must come up against. The reality project, that is. I agree with Beller in that, “My aim is not to cure this ‘schizophrenia’ by eliminating the inconsistencies, but to analyze the sources, uses, and aims of such shifting philosophical positions . . .”

I think the best things in the list are Honner, Holton, and Faye’s three books. Kalckar is good because it has a lot of previously unpublished personal letters to and from Bohr on meaty reality issues. If you’re looking for the most on Møller’s book, take a look at Feuer, Faye, MacKinnon, and Holton. The collection edited by Faye and Folse is really good too. I’d especially recommend “Description and Deconstruction: Niels Bohr and Modern Philosophy,” by John Honner, in it. The book by Plotnitsky was strongly recommended by David Mermin,

but I haven't made much headway into it—the subject is deconstructionism, Derrida, and the connection of all that to Bohr and Gödel.

I have still several more things to put in the list for you, but you'll have to give me some time to dig them up.

1. Mara Beller, “The Rhetoric of Antirealism and the Copenhagen Spirit,” *Philosophy of Science* **63**, 183–204 (1996).
2. Jan Faye and Henry J. Folse, eds., *Niels Bohr and Contemporary Philosophy*, (Kluwer, Dordrecht, 1994).
3. Jan Faye, *Niels Bohr: His Heritage and Legacy (An Anti-Realist View of Quantum Mechanics)*, (Kluwer, Dordrecht, 1991).
4. Lewis S. Feuer, *Einstein and the Generations of Science*, (Basic Books, New York, 1974).
5. Henry J. Folse, *The Philosophy of Niels Bohr: The Framework of Complementarity*, (North Holland, Amsterdam, 1985).
6. A. P. French and P. J. Kennedy, *Niels Bohr: A Centenary Volume*, (Harvard University Press, Cambridge, MA, 1985).
7. Gerald Holton, *Thematic Origins of Scientific Thought: Kepler to Einstein*, Revised Edition, (Harvard University Press, Cambridge, MA, 1988).
8. John Honner, *The Description of Nature: Niels Bohr and the Philosophy of Quantum Physics*, (Oxford University Press, Oxford, 1987).
9. Jørgen Kalekar, *Niels Bohr, Collected Works: Volume 7, Foundations of Quantum Physics II (1938-1958)*, (Elsevier, Amsterdam, 1996).
10. Edward M. MacKinnon, *Scientific Explanation and Atomic Physics*, (University of Chicago Press, Chicago, 1982).
11. Dugald Murdoch, *Niels Bohr's Philosophy of Physics*, (Cambridge University Press, Cambridge, 1987).
12. Abraham Pais, *Niels Bohr's Times, in Physics, Philosophy, and Polity*, (Clarendon Press, Oxford, 1991).
13. Arkady Plotnitsky, *Complementarity: Anti-Epistemology after Bohr and Derrida*, (Duke University Press, Durham, NC, 1994).

## 12 October 1997, “Reality as Realty”

I'm just thinking of you, as I often do on my leisurely Sundays. Today's treat comes from the LA Times Book Review: an article by Martin Gardner, titled “Mathematical Realism and Its Discontents.”

Consider  $2^{1,398,269} - 1$ . Not until 1996 was this giant number of 420,921 digits proved to be prime . . . . A realist does not hesitate to say that this number was prime before humans were around to call it prime and that it will continue to be prime if human culture vanishes. It would be found prime by any extraterrestrial culture with sufficiently powerful computers.

Social constructivists prefer a different language. Primality has no meaning apart from minds. Not until humans invented counting numbers, based on how units in the external world behave was it possible for them to assert that all integers are either prime or composite . . . . In a sense, therefore, a computer did discover that  $2^{1,398,269} - 1$  is prime, even though it is a number that wasn't "real" until it was socially constructed. All this is true, of course, but how much simpler to say it in the language of realism!

The last sentence just pegs it for me. Take reality when you can, I say! But when it's simpler to let it go, you've got to do that too. As I see it, that's the place quantum mechanics leaves us. For instance, Bohm's realistic version of QM seems to be perfectly consistent and to give the same observable results. All this is true, but how much simpler to say it in the language of anti-realism!

Oh well, enough of that.

### **13 November 1997, "Tria Juncta In Uno"**

I'm starting to think that writing proposals might be more useful than I could have imagined. Look at what I just found in my electronic thesaurus for the word "REAL". In particular notice "well-documented"!

REAL: real, essential, substantive, substantial, not imagined, uninvented, actual, positive, factual, genuine, well-documented, historical, grounded, well-grounded, true, natural, of nature, physical, flesh and blood, material, concrete, solid, tangible, dense

### **23 November 1997, "Sunday Baudrillard"**

I'm reading Jean Baudrillard and eating Kiki's famous sourdough raisin-pecan biscuits this morning. Ever heard of the guy? Baudrillard, that is. Anyway, I ran across the following little quote:

The transition from signs which dissimulate something to signs which dissimulate that there is nothing, marks the decisive turning point.

When do you think that was? 1926-27, maybe?

### **28 November 1997, "Muddling Through Reality"**

I look forward to reading your book: just send it when you can. (If it arrives here before December 20, I can take it to Texas with me . . . for reading on my vacation, Dec. 20 through Jan. 2.)

Yes, Baudrillard is contemporary. The reference to 1926-1927 in my first mention of him was a joke! It was meant to signify the birth of quantum mechanics.

### **10 December 1997, "Reality Alert I"**

I've got a tip for you! Yesterday, I ran across a wonderful article that I know will please you immensely. It's by S. S. Schweber: "The Metaphysics of Science at the End of a Heroic

Age,” in *Experimental Metaphysics*, edited by R. S. Cohen, M. Horne, and J. Stachel (Kluwer, Dordrecht, 1997), pp. 171–198.

I think one of the S’s in Schweber’s name stands for Sam ... is that true? Anyway, the subject is roughly speaking “law without law” ... the mutability of physical laws ... the creation of reality ... and an evolutionary universe. Roughly all the stuff of which Wheeler used to speak. The twist here is that he spends a little time exploring ethics and morals in such a kind of world. Let me give you an excerpt:

Since ... the scientific enterprise is presently involved in the creation of novelty—in the design of objects that never existed before in the universe and in the creation of conceptual frameworks to understand the complexity and novelty that can emerge from the *known* foundations and ontologies—they must assume moral responsibility for these objects and representations. My emphasis on the act of creation ...

and, quoting C. S. Peirce,

Under this conception, the ideal of conduct will be to execute our little function in the operation of the creation by giving a little hand toward rendering the world more reasonable whenever, as the slang is, it is ‘up to us’ to do so.

Besides, the article also has a lot of wonderful references to stuff on “law without law” that I hadn’t known about. You should take a look. (There is, however, an annoying thing in it: (1) he consistently misspells Peirce’s middle name—it is Sanders not Saunders.)

David Mermin spent four days here last week, and we had a lot of time to discuss the “Ithaca Interpretation of QM.” I would say that, to a large extent, he’s on our side of the game. I.e., the anti-realism side. That, somehow, though hasn’t come out in this particular twist of his thinking. I showed him something you once wrote me complaining that he’s slipping away from our side, and he had a good laugh. He’s a very good guy; I like him a lot.

## 10 December 1997, “List of Sins”

Herbert, Herbert, Herbert,

I am so disappointed in you. What’s it take for a guy to be treated with respect by you ... perhaps a *faculty* appointment at Caltech??? Let me list your sins:

1) Not only did you send Hideo’s copy of your book by priority mail (\$4.00 postage), while only sending mine by “special standard mail,”

but

2) You placed \$1.28 of postage on it when it apparently required \$2.24 worth. Caltech had to pay 96 cents for me to have the privilege of your words!

I just hope you know that I’m hurt. Please return the e-mail I wrote you this morning about Schweber’s article: I can no longer bear knowing that I’m sharing my thoughts with you. (This time though, please use the correct postage!)

Christopher

PS. The zip code at Caltech is 91125, not 91109.

## 27 December 1997, “Reality Alert II”

Thanks for your comments about Schweber, etc. This “reality” issue is becoming more acute, isn’t it? I’ve very enthusiastic about it all again lately. I read the preamble and the amble of your book the other day on the plane. So far at least, I’ve been enjoying it immensely.

Mermin really is a good guy. His take on reality is, I think, somewhere between the Bernstein–Fuchs of the world and the hardcore realists. In general, he gives a thumb’s down to reality . . . so I guess that makes him much closer to our side of the mark. He just doesn’t seem to think that quantum mechanics itself is about reality creation. That takes place—according to him, that is . . . or at least I think so—at a somewhat higher level.

I wrote him an extensive critique of the Ithaca Interpretation (in its latest incarnation). After he puts his long paper on the archive, I may make my note available for public perusal (but it’s not something I would put on the net). In general, there is a lot that I like about his way of viewing things—but I think it points much more strongly than he believes to the idea that quantum mechanics is about *information* and nothing more. By studying him, I’ve been able to come to much better grips concerning what I think quantum mechanics is about. I’ve been summarizing my latest understanding with the pithy phrase, “Bohr was Bayesian!”

## 29 December 1997, “Cradle of Reality”

Guess where Kiki and I are heading off to this morning? Austin, Texas: for me, the cradle of reality-creation. It was there that I first became acquainted with John Wheeler’s ideas, and somehow the town has a mystical hold on me. Wish me luck for a little more insight.

## 04 January 1998, “Bohr, Bayesians, and Bernsteins”

I’m back in California now. On the ride home, I managed to get another chapter read from your book with Mike Fortun. (Yes, I would like to meet him.) I’m sorry that my reading is going slower than I had imagined it would. I just found that I was in hardly any mood to be intellectual over the holidays. So I still can’t give you much feedback on it other than that I am wholly in agreement with the point of view espoused in Chapter 1. Most important to me, in particular, is the issue of articulating what exactly this new category “*reality*” consists of. What concept or category can we take to replace “reality” in a world where our actions actually make a difference? I think that is a lovely question!! I don’t think I had ever seen it posed so pointedly before reading this Chapter. So thanks for giving me the opportunity. (If I can dig them up, I’ll send you some of my old meager attempts at *even* formulating this question—I didn’t come quite so close to the mark as you guys have!)

Thanks for commenting on my phrase “Bohr was a Bayesian” and the idea that quantum mechanics is about information. Actually I didn’t mean by it anything so detailed as Bohr’s particular take on the “frequency interpretation of probability,” etc. I think what I really mean by the phrase is encapsulated in the following two-sentence explanation. Bohr was willing to own up to the idea that quantum theory is a theory of “what we have the right to say” in a world where the observer cannot be detached from what he observes. He was willing to own up to the idea that it is that and nothing more. (Making these two sentences rigorous and useful is roughly the big picture of my present research program. Did you, by chance, read the research proposal that I sent you? If you have any feedback, I *would* like to hear it.) My most up-to-date attempt to say this clearly is in a couple of notes—one to Comer and one to Mermin—I’ll go ahead and forward them on to you in case you’re interested. (Read the

one to Comer first, for the overview.) [Letter to Comer reproduced below. For the “note” to Mermin, see the entries in the range 10 through 17 December 1997 of *Notes on a Paulian Idea*, [arXiv:quant-ph/0105039](https://arxiv.org/abs/quant-ph/0105039).]

Oh yeah, and on a related note, I did want to comment on something you said,

I got the idea that “Ithaca” was about the possibility that q-mech somehow was only connected to information. To my mind this is a bit close to the folks in our field who think the universe is only information. That always seemed to trivialize what a marvelous theory quantum mechanics is – both philosophically and practically. Just misses the whole point, like the related stance of many-worldism.

To say something like that is to “ontologize” information. When I say, “Quantum mechanics is almost totally about information,” that is not at all the sort of thing that I am trying to imply. Instead, I am trying to relate that almost all the formal structure of quantum theory (i.e., Hilbert spaces, state vectors, unitary evolution, etc.) is not really about *physics* at all. There is almost no physics in that formal structure: it is rather something of a more Bayesian-like character, it is about the formal tools for describing what we know. The *physics* behind quantum theory is that: “reality” *must* be replaced by “reality” (to borrow a little from your terminology).

**Letter to Greg Comer (excerpt), 4 January 1998:**

Lately I’ve been thinking about the program of Law Without Law again. Perhaps it’s just a fancy form of procrastination. I keep dreaming of the day when all this will become immaculately clear, and we will have the start of a new physics. I guess I’ve been saying this for eight years, but it seems that it really must be just around the corner: I think we’re almost at a point where the possibilities in our world will open up like a blooming flower.

Ever more I am compelled to believe that the ontology of Wheeler’s “game of twenty questions, surprise version” is not only a central lesson of quantum theory, but actually the singular principle upon which the detailed structure of the theory is built. The “fact” that *my* information-gathering yields a disturbance to *your* predictions is the only “physical” (or ontological) statement that the theory makes; all the rest of the structure is “law of thought” subject to that consideration. To put it another way, quantum theory is a theory of “what we have the right to say” in a world where the observer cannot be detached from what he observes. It is that and nothing more.

The central issue then becomes: what are the further implications of this “lack of detachedness” for observers? Now that we know that it is actually the essence of quantum phenomena, what can we do with it? Quantum cryptography is a nice applied example of that line of thought. But there’s got to be so much more. It seems to me that we’re almost poised in the same way that Einstein was when he finally formulated the physical/ontological observation that “maybe it’s not coincidental or accidental that gravitational and inertial mass are numerically the same.” It was then just a question of counting the time until something wonderful came out of its asking.

Anyway, thanks for lending me your ear this afternoon. Did I send you the notes I wrote on David Mermin’s Ithaca Interpretation of QM? I don’t think I did ... or at least I can’t find a record of it. In case I didn’t—and, in case you’re interested(!)—I’ll forward them on to you following this note. I say the same things there that I did above, but perhaps in slightly more detail. (See especially the stuff from pages 9 through 12—all the stuff following Merminition 10.)

## 14 January 1998, “Quote-A-Day”

New quote. (My computer gives me one at random every day.) I’m not sure why I like it, but somehow it strikes me as having something to do with the “muddled middle” you speak of in your book.

The very purpose of existence is to reconcile the glowing opinion we have of ourselves with the appalling things that other people think about us.

It’s by Quentin Crisp (b. 1908), British author, from *How to Become a Virgin*, ch. 2 (1981).

## 25 January 1998, “Shame Dance”

I’m ashamed to say, but only now I’ve just finished reading Chapter 2 (“Articulating Experiments”) of your book with Fortun. Time (and much of my sanity) has just slipped away from me this semester: true to your analysis, my life is very much a kludge job. All I can say still is that I very much like this idea of “reality.” It shines through to me as the most important of ideas. But with all the silly travel that I have to do this coming month (and the preparation of talks for it), it’ll probably be some time before I can really get into the book again. Let me apologize for that right now: I know that I’m not being of very much use to you in your publishing process. But there certainly is enough in the book to keep me wanting to come back to it.

## 02 March 1998, “Early Morning Japan”

It’s early morning in Japan right now, and I’m having trouble sleeping. My clock’s still running on California time. I was thinking of you, wondering how you’re doing. I’ve spent the last few listless hours in bed trying to compose a little reality, trying to give the world a little form in exchange for the form it gave me. You should see this joint I’m staying at! It’s the Tamagawa University guest house, and I’m sure by Japanese standards it is a palace. Very comfortable. Alexander Holevo and I are sharing it for seven days. Then I move on to visit the Communications Research Laboratory of the Ministry of Posts & Telecommunications for three days. I’ve been warned that my living arrangements there will not be so nice.

## 08 March 1998, “The Soul of Daibutsu”

This is just a short note to wish you well before I leave Japan. A few days ago I saw the most moving sight: The Great Buddha of Kamakura, Daibutsu. It’s a 44 foot tall bronze buddha; I was even able to walk inside its belly. Dreams of philosophy made my heart pound. At a nearby shrine, I placed a 500 yen wish on their “wish board” (with about 10,000 previous wishes): Wish for Reality. I hope you won’t mind my pirating your phrase, but there was just nothing else to better describe what I was truly wishing for at just that moment.

Most honorable regards. Your faithful bhikku,

Christopher

## 29 March 1998, “Philosophical Purgation”

I’m doing my usual thing of being philosophical on Sunday. I’ve come across a little piece of an interview with David Bohm that I sort of like the flavor of . . . so I’m entering it into my usual Sunday database: my friends. I’ll pick on you because I know that your wife (and maybe you) resonates with some of Mr. Bohm’s ideas.

Q: You said that there was difficulty in understanding quantum mechanics.

A: Yes. I think that the difficulty is that we have no way of understanding what is actually happening, or what I call the *actual fact*. If I may paraphrase Bohr, we have only the phenomena, i.e., the observed phenomena, which are essentially classical in their description. Ordinary classical phenomena—the observation of a dot or a click—were previously understood to signify information about particles, and the particles were independent of these phenomena. Now, if you analyse the Heisenberg microscope experiment, you come to the conclusion that the experiment cannot give you unambiguous information about the structures you are supposed to be observing. Therefore, there is no clear way of considering the unknown reality which is responsible for the experimental results.

Q: Wouldn’t Bohr have said that this is a fundamental property of the world?

A: In effect he did say that. I don’t think he ever said it directly, but it was implied. But if he said that it is fundamental, then I ask: how does he know it’s fundamental? It’s only fundamental as long as the present theory works, and there are many ways in which it doesn’t work, as we know. We certainly just can’t accept it on authority that it is fundamental. . . .

I think the reason I like this little passage is that Bohm shows that he did indeed have a good understanding of the Copenhagen attitude. He simply chose to reject it. There’s nothing in my mind better than an honest assessment of one’s motives. I myself keep playing with the idea that all of quantum mechanics is about one fundamental ontological statement: Wheeler’s game of twenty questions. Almost all of the detailed structure of the theory is about reasoning, betting, assessing, and dealing with a world possessing exactly that fundamental property. Once we clear up that that is what quantum mechanics is really about, then we will really be in a position to find something truly new and wonderful. So the point that Bohm wishes to question is just the point that I want to take as basic, the one I wish to see if it can be built upon.

That’s all. Happy philosophy.

## 02 January 1999, and to Greg Comer, “A New Year’s Toast”

Happy New Year! Please allow me to toast it in with a small gift, one that I think concerns all three of us. It’s a beautiful little article from *Science* magazine by John Banville (a reporter at the *Irish Times* in Dublin). I scanned the article in its entirety because the whole thing seemed so relevant. It contains a truth that I think we three in particular know all too well . . . a truth that we three in particular want to see become a *productive* truth.

Beauty, Charm, and Strangeness: Science as Metaphor  
(From Science Magazine Online)  
by John Banville

I wish to advance a thesis which, were they to take note of it, the academies would decry as scandalous. My thesis is that modern science, particularly physics, is being forced, under pressure of its own advances, to acknowledge that the truths it offers are true not in an absolute but in a poetic sense, that its laws are contingent, that its facts are a kind of metaphor. Of course, art and science are fundamentally different in their methods, and in their ends. The doing of science involves a level of rigor unattainable to art. A scientific hypothesis can be proven—or, perhaps more importantly, *disproven*—but a poem, a picture, or a piece of music, cannot. Yet in their *origins* art and science are remarkably similar. It was a scientist, Niels Bohr, who declared that a great truth is a statement whose opposite is also a great truth. Oscar Wilde would have agreed.

Since the Enlightenment, the chasm between art and science has yawned ever wider with each new stage in the campaign to subdue nature to man's will. The human race cannot abide nature's indifference, and uses the physical sciences to attempt to wring from it a word of acknowledgment. Yet what we today think of as science is for the most part not science at all, but *applied* science, that is, technology. The machinery of modern science is so elaborate, and the building of it requires so much ingenuity—requires, indeed, so much *science*—that we naturally confuse the thinking with the doing. The great particle accelerator at CERN, for example, is for us the very image of modern science: a vast and inconceivably expensive machine built to perform minute and unimaginably complex operations whose results can be interpreted only by a handful of physicists. But we are willing to pay the cost of building these machines, are willing to allow the physicists their arcane rules and specialized language, because we believe that they are getting their hands into the very bowels, or, rather, the very synapses, of nature. And at some point, we believe, they will bring forth news of another advance, another boiled-down version of the world's variousness, another  $E = mc^2$ , only bigger and better. Perhaps this time they may even discover the final equation, the Grand Theory of Everything. Then, as Stephen Hawking puts it, “we shall all, philosophers, scientists, and just ordinary people [I am struck by that distinction, by the way], be able to take part in the discussion of the question of why it is that we and the universe exist. If we find the answer to that, it would be the ultimate triumph of human reason—for then we would know the mind of God.”

Such foolhardy talk, from such an eminent source, misleads us into the notion that the aim of science is to find the “meaning” of the world. That there must be a meaning seems certain, otherwise how is it that there is such a thing as progress? Science keeps uncovering more and more secrets, keeps getting closer and closer to . . . well, to *something*, in the same way that computations in the infinitesimal calculus keep approaching nearer and nearer to infinity without ever getting there. Progress must be progress *toward* something, surely, some final end to the quest for knowledge? But to my mind the world has no meaning. It simply *is*. Leibniz's thrilling question, “Why is there something rather than nothing?” is significant not because an answer to it is possible, but because out of the blind, boiling chaos that is the world, a species should have emerged that is capable of posing such a question.

Science and art are different ways of looking at the same thing, namely, the world. Let us take the case of Goethe. In his role as amateur scientist, he was vehemently opposed to Newton's mechanistic model of reality. He was mistaken—that is to say, his science was bad science, although his scientific writings are not bad philosophy, and still less are they bad poetry. Goethe demanded that science should always hold to the human scale. He opposed the use of the microscope, since he believed that what cannot be seen with the naked eye should not be seen, and that what is hidden from us is hidden for a purpose. In this, Goethe was a scandal among scientists, whose first, firm, and necessary principle is that if something *can* be done, then it *should* be done. Yet his furious denial of Newton

was more than merely the bloodshot jealousy of one great mind drawing a bead on another. Goethe's theory of light is wrong insofar as the science of optics is concerned, yet in the expression of his theory Goethe achieves a pitch of poetic intensity that is as persuasive, in its way, as anything Newton did. But persuasive at what level?

There is a world beyond politics, says the poet Wallace Stevens, and we might adapt that to say that there is a world beyond science, or, at least, there is a world beyond *the current state* of science. At the end of the 19th century professors of physics in the great European universities were steering students away from the discipline because they believed that there was very little of interest left to be discovered about the nature of physical reality. Then came Einstein. As we approach the end of the 20th century, we are still guilty of hubris, as evidenced by Stephen Hawking's statements quoted above. Probably a Unified Field Theory will be achieved, and will seem for a time, perhaps even as long as the period between Newton's *Principia* and Einstein's first paper on the theory of relativity, to explain everything; then a Heisenberg or a Gödel will come forward and point to a loose end which, when pulled, will unravel the entire structure.

This is a truth that both clear-sighted artists and scientists—that is, those not blinded by hubris, or a cramped imagination, or both—have always acknowledged: There is no end to the venture. The difference between the two, however, is that while the artist acknowledges that in art there is nothing new to be said, only new ways of saying the old things, new combinations of old materials—a process, paradoxically, that *makes* a new thing, namely, the work of art—science seems always to be pressing on into hitherto uncharted territory. Yet the fact is, science is not *making* this new landscape, but *discovering* it. Einstein remarked more than once how strange it is that reality, as we know it, keeps proving itself amenable to the rules of man-made science. It certainly is strange; indeed, so strange, that perhaps it should make us a little suspicious. More than one philosopher has conjectured that our thought extends only as far as our capacity to express it. So too it is possible that what we consider reality is only that stratum of the world that we have the faculties to comprehend. For instance, I am convinced that quantum theory flouts commonsense logic only because commonsense logic has not yet been sufficiently expanded.

I am not arguing that art is greater than science, more universal in its concerns, and wiser in its sad recognition of the limits of human knowledge. What I am proposing is that despite the profound differences between them, at an essential level art and science are so nearly alike as to be indistinguishable. The only meaningful distinction I can see between the two is that science has a practical extension into technology, and art does not. But this is a distinction only in terms of utility. At the level that concerns me, the level of *metaphor*, art and science are both blithely inutile—at this level, for instance, the theory of relativity has nothing to do with the atomic bomb.

The critic Frank Kermode has argued, persuasively, I believe, that one of art's greatest attractions is that it offers "the sense of an ending." The sense of completeness that is projected by the work of art is to be found nowhere else in our lives. We cannot remember our birth, and we shall not know our death; in between is the ramshackle circus of our days and doings. But in a poem, a picture, or a sonata, the curve is completed. This is the triumph of form. It is a deception, but one that we desire, and require.

The trick that art performs is to transform the ordinary into the extraordinary and back again in the twinkling of a metaphor. Here is Wallace Stevens again, in lines from his poem *Notes Toward a Supreme Fiction* (1942):

You must become an ignorant man again  
And see the sun again with an ignorant eye  
And see it clearly in the idea of it.

This is the project that all artists are embarked upon: to subject mundane reality to such intense, passionate, and unblinking scrutiny that it becomes transformed into something rich and strange while yet remaining solidly, stolidly, itself. Is the project of pure science

any different? When Johannes Kepler recognized that the planets move in elliptical orbits and not in perfect circles, as received wisdom had for millennia held they must do, he added infinitely to the richness of man's life and thought. When Copernicus posited the horrifying notion that not the Earth but the sun is the center of our world, he literally put man in his place, and he did it for the sake of neither good nor ill, but for the sake of demonstrating *how things are*. When, probably early in the next millennium, quantum theory gives up its secrets, we shall see the world again with a new, ignorant eye—not as a blizzard of atoms, not as a speck whirling in an unimaginable immensity of darkness, not even as that blue-and-white marble photographed by the first moon travellers, the beauty of which took our breath away—as our ordinary and always known home, which is the world that art and science alike, even in their most seemingly transcendental modes, are concerned with. In the 1970s, when quantum theory began employing such terms as “beauty,” “charm,” and “strangeness” to signify the various properties of quarks, a friend turned to me and said: “You know, they’re waiting for you to give them the words.” I saw what he meant, but he was not quite right: Science does not need art to supply its metaphors. Art and science are alike in their quest to reveal the world. Rainer Maria Rilke spoke for both the artist and the scientist when he said:

Are we, perhaps, *here* just for saying: House, Bridge, Fountain, Gate, Jug, Fruit tree, Window,—possibly: Pillar, Tower? . . . but for *saying*, remember, oh, for such saying as never the things themselves hoped so intensely to be.

### 03 January 1999, “Mary and Banville”

I forgot to tell you: Also please share the Banville article with Mary. I would be interested in knowing her opinion on it. Does the artist think this is as much hogwash as the average physicist probably does? (You and I aren't so average.)

The point I find most eloquently stated in that article is where Banville says:

Einstein remarked more than once how strange it is that reality, as we know it, keeps proving itself amenable to the rules of man-made science. It certainly is strange; indeed, so strange, that perhaps it should make us a little suspicious. More than one philosopher has conjectured that our thought extends only as far as our capacity to express it. So too it is possible that what we consider reality is only that stratum of the world that we have the faculties to comprehend.

To bring a similar point home in a talk I give on the “real meaning of quantum information,” I use three slides that I'm particularly proud of. This first is one I stole from Seth Lloyd from his talk at the QUIC Kickoff meeting. It shows a tall mountain labelled with “novel quantum states” at the bottom and “factoring” at the top, and some clouds in between. I say, “It has become popular to show slides like this . . . to depict graphically the mountain we must climb in quantum computing. It gives the idea that the thing we really want is that peak. But if you ask me, the real reason to climb from the base to the peak, is to gauge the distance between the two.” Then I change slides to one of iceberg that Kiki drew for me. (There's a little boat near the iceberg, and a penguin sitting on its peak.) “If we can gauge that distance, then we'll have a better feel for the other 8/9 that's still below the surface!” Then I say that the source of that belief has no logical justification, but it seems that physicists have lately gotten in a habit of ignoring a pretty basic fact of the world. Then I show a slide copied from a biology book, “Amino Acid Difference Matrix for 26 Species of Cytochrome c.” I've got *man* and *dog* highlighted in yellow on it; the difference is only 11 percent. Then I say, “My dog isn't even close to a Grand Unified Theory of the universe. There are some things he just can't see, no

matter how hard I try to train him. Why should we be much more than 11% ahead of him in the game?”

## 24 April 1999, “Genetic Genesis”

OK, I still haven’t read through Fleck again. But I keep thinking I’m going to. Does that count for anything?

Anyway I really would like you to write up a report on that wonderful conversation we had with Charlie the other night. It would be sad if it faded from our collective memory. Of the three of us, you seemed to have the deepest understanding of all that was being said and, on top of that, to have a glimpse of how to conciliate all three points of view. So please, please do it for me.

As a bit of a peace offering in the mean time, let me send you two things. The first is a small essay I wrote a couple of days ago to firm up how I might present my research program in a sort of evocative way. It’s based on the Adam and Eve slide I showed you. I think you’ll enjoy it; it’s placed below. [See note to Greg Comer, titled “Fuchsian Genesis,” dated 22 April 1999, reproduced below.] The other thing, coming in the next email, is a passage from a paper by Doug Bilodeau. [See letter to Asher Peres, titled “The Deep Intervention,” dated 26 December 1998, reproduced below.] It expresses very clearly what I was trying to convey to Charlie about the scientist as the setter of initial conditions. He thinks that is absolutely incidental and unimportant for science (an epiphenomenon?), but I just don’t think so. I guess the essay below and Bilodeau’s passage both express this. I’d love to hear your opinions (along with the stuff I begged for above).

### Letter to Greg Comer, 22 April 1999, “Fuchsian Genesis”

In the beginning God created the heaven and the earth. And the earth was without form, and void; and darkness was upon the face of the deep. And the Spirit of God moved upon the face of the waters. And God said, Let there be light: and there was light. And God saw the light, that it was good; and God divided the light from the darkness. And God called the light Day and the darkness he called Night. And the evening and the morning were the first day. . . . [Day 2], [Day 3], [Day 4], [Day 5] . . . And God saw everything that he had made, and behold, it was very good. And there was evening and there was morning, a sixth day. Thus the heavens and the earth were finished, and all the host of them.

But in all the host of them, there was no science. The scientific world could not help but *STILL* be without form, and void. For science is a creation of man, a project not yet finished (and perhaps never finishable)—it is the expression of man’s attempt to be less surprised by this God-given world with each succeeding day.

So, upon creation, the society of man set out to discover and form physical laws. Eventually an undeniable fact came to light: information gathering about the world is not without a cost. Our experimentation on the world is not without consequence. When *I* learn something about an object, *you* are forced to revise (toward the direction of more ignorance) what you could have said of it. It is a world so “sensitive to the touch” that—with that knowledge—one might have been tempted to turn the tables, to suspect a priori that there could be no science at all. Yet undeniably, distilled from the process of our comparing our notes with those

of the larger community—each expressing a give and take of someone’s information gain and someone else’s consequent loss—we have been able to construct a scientific theory of much that we see. The world is volatile to our information gathering, but not so volatile that we have not been able to construct a successful theory of it. How else could we, “Be fruitful, and multiply, and replenish the earth, and subdue it?” The most basic, low-level piece of that understanding is quantum theory.

The *speculation* is that quantum theory is the unique expression of this happy circumstance: it is the best we can say in a world where *my* information gathering and *your* information loss go hand in hand. It is an expression of the “laws of thought” best molded to our lot in life. What we cannot do anymore is suppose a physical theory that is a direct reflection of the mechanism underneath it all: that mechanism is hidden to the point of our not even being able to speculate about it (in a scientific way). We must instead find comfort in a physical theory that gives us the means for describing what we can *know* and how that *knowledge* can change (quantum states and unitary evolution). The task of physics has changed from aspiring to be a static portrait of “what is” to being “the ability to win a bet.”<sup>1</sup>

This speculation defines the large part of my present research program.

Why do I say all this? Because I wanted to say it to myself and use you as the other side of my brain. Today I’m going to lunch with Roger Penrose and there is no doubt that the topic of the interpretation of quantum mechanics will come up. How best to express what needs expression? That’s the question on my mind this morning: this is iteration #1.

#### **Letter to Asher Peres, 26 December 1998, “The Deep Intervention”**

Well I have finally had some time to read through your new draft of RQM completely. I am not sure, however, what I should compose as comment yet—I think I will chew upon it for a while, before saying anything more. In the mean time, let me share a passage I just entered into my computer by way of my “voice recognition system.” These came from a recent paper on **quant-ph** by Doug Bilodeau, “Why Quantum Mechanics is Hard to Understand.” In his introduction he says, “In this paper I present the conceptual system which I think gives the clearest understanding of what it is we are doing when we use quantum mechanics.” I think he fails at that, as I cannot figure out what he is talking about for much of the paper. *But*, there were some parts of the paper that struck me as particularly deep. The passage below was one of them. It concerns another use of the term “intervention,” one that I am particularly fond of (but is maybe a little more risky than the meaning you introduce in your paper). I hope you enjoy it as much as I did.

A thing is historical insofar as it is objective (can be observed and treated as an object). It then enters into the realm of recordable objective occurrences which can be ordered in historical space and time. It is dynamical insofar as it is defined as an abstract element of the dynamical theory which explains causal relationships between objects. . . .

Imagine that we could see the universe as omniscient external observers, all space and time at once, and that what we “see” is a tangle of intersecting particle world-lines (cf. Ch. 1 of Misner, Thorne, and Wheeler). We might detect some patterns which would constitute physical rules or laws in some sense, but it would be quite difficult or impossible

---

<sup>1</sup>The nice phrase “physics is the ability to win a bet” is due to J. R. Buck (a grad student at Caltech) circa 19 February 1999.

to know whether we had found all the important patterns, or to distinguish significant relationships from accidental ones. Even more difficult would be to translate this omniscient description into the kinds of relationships and laws which would be observed by the huge clumsy bunches of world-lines which constitute ourselves.

When we set out to investigate Nature, we are not like that external omniscient observer at all. We look for relationships and patterns in the behavior of objects we know. We want to find out—does this kind of object always behave this way under these circumstances? The phrases “this kind,” “this way,” and “these circumstances” imply the ability to abstract relevant or significant features from what are really unique events. They also imply that we can find or (even better) set up many instances of these typical situations. The result is that the concepts we develop to describe physical phenomena depend not only on what we can observe, but also on what we can do.

To say that A affects or causes or influences or interacts with B implies a counterfactual: If A had been different, B would have been different, too. The most convincing way to establish a connection is to “wiggle” some parameter in A more or less randomly and then observe the same odd pattern showing up in some property of B. If I want to know whether a wall switch controls a certain light, I can flip the switch on and off and observe whether the light follows my actions. There is always the possibility that the light is being controlled by someone else or goes on and off spontaneously; but if I put the switch through a very irregular and spontaneous sequence of changes and the light still follows along, then the probability of a causal connection is very high (barring a conspiracy to deceive the experimenter).

Physical theory is possible because we *are* immersed and included in the whole process—because we can act on objects around the us. Our ability to intervene in nature clarifies even the motion of the planets around the sun—masses so great and distances so vast that our roles as participants seems insignificant. Newton was able to transform Kepler’s kinematical description of the solar system into a far more powerful dynamical theory because he added concepts from Galileo’s experimental methods—force, mass, momentum, and gravitation. The truly external observer will only get as far as Kepler. Dynamical concepts are formulated on the basis of what we can set up, control, and measure.

## 08 May 1999, “A Fleck of Quantization”

The last time I wrote you about Ludwik Fleck’s book *Genesis and Development of a Scientific Fact*—1 October 1995, can you believe it!?!—I said the following:

---

Another piece of news is that I’ve finally finished reading Fleck’s book. It was indeed worth taking a look at, though I’m not yet sure what to make of it. In this “reality generation” business, I see the quantum as a crucial ingredient. But Kuhn and Fleck seem to argue otherwise. It’s amazing how deeply ingrained I find the “realist” tendency. Because quantum theory apparently forces me to relinquish

some of my intuitions, I'm willing to give these spookier ideas a shot . . . but always some resistance remains. In any case, I was intrigued that Fleck and I have come to similar ideas about the "stability of reality." (Cf. one of my old notes titled "Insights from Cuero" or something like that—it's the one that contains stuff about the burnings in Waco.)

These are the little notes I compiled; maybe you'll find them useful too.

1. crossing thought style – p. 2
2. reality – p. 10, 28 (bottom), 127 "Our reality did not exist for them", 156
3. resistance – p. 27
4. individual cognition dependent upon community – p. 38
5. contribution of the individual – p. 40
6. slacker reference – p. 44
7. stability of reality – p. 47, 99, 102
8. thought collective being cultural and not across the board for humankind – p. 174 (note p. 49)
9. French bread – p. 50
10. existence is lawless – p. 51
11. truth – p. 100, 116, 125
12. fact as thought-collective resistance – p. 101
13. objects created by thought – p. 181
14. how to use philosophical principles – p. 181
15. symbols – p. 125
16. name as property – p. 136
17. meaning as a property of the object – p. 137

---

Apparently this made little impression on you: you told me you didn't even remember my sending it! So let me bless you with something of an expanded version.

In what follows I revisit those marked sections and copy down what it was that I found interesting. In a small number of cases, I couldn't figure out what I found interesting last time; so those citations got skipped this time around. Also, a few of the subjects got renamed.

Reading over it all again, I guess I find that I'm significantly more impressed than I was last time. Perhaps the years have made me wiser. Or perhaps they've caused me to return to my youth: you'll see what I mean shortly. I think your forcing me to look through Fleck again was particularly timely. This is because the little tale "Fuchsian Genesis" I sent you the other day. I continue to think quantum mechanics supplies a crucial piece that Mr. Fleck couldn't have foreseen.

Throughout I'll make commentary here and there, and even annotate with some of my old writings. At the end, I'll sum up my present thoughts on the *Denkkollektiv*. And then you must fulfill your promise!

## A Few of Fleck's Thoughts (with Annotation)

*Resistance — p. 27:*

Once a structurally complete and closed system of opinions consisting of many details and relations has been formed, it offers enduring resistance to anything that contradicts it.

A striking example of this tendency is given by our history of the concept of “carnal scourge” in its prolonged endurance against every new notion. What we are faced with here is not so much simple passivity or mistrust of new ideas as an active approach which can be divided into several stages. (1) A contradiction to the system appears unthinkable. (2) What does not fit into the system remains unseen; (3) alternatively, if it is noticed, either it is kept secret, or (4) laborious efforts are made to explain an exception in terms that do not contradict the system. (5) Despite the legitimate claims of contradictory views, one tends to see, describe, or even illustrate those circumstances which corroborate current views and thereby give them substance.

*Individual cognition dependent upon the community — pp. 38-39:*

In comparative epistemology, cognition must not be construed as only a dual relationship between the knowing subject and the object to be known. The existing fund of knowledge must be a third partner in this relation as a basic factor of all new knowledge. It would otherwise remain beyond our understanding how a closed and style-permeated system of opinions could arise, and why we find, in the past, rudiments of current knowledge which at the time could not be legitimized by any “objective” reasons and which remained only pre-ideas.

Such historical and stylized relations within knowledge show that an interaction exists between that which is known and the act of cognition. What is already known influences the particular method of cognition; and cognition, in turn, enlarges, renews, and gives fresh meaning to what is already known.

Cognition is therefore not an individual process of any theoretical “particular consciousness.” Rather it is the result of a social activity, since the existing stock of knowledge exceeds the range available to any one individual.

The statement, “Someone recognizes something,” whether it be a relation, a fact, or an object, is therefore incomplete. It is no more meaningful as it stands than the statements, “This book is larger,” or “Town A is situated to the left of town B.” Something is still missing, namely the addition, “than that book,” to the second statement, and either, “to someone standing on the road between towns A and B while facing north,” or “to someone walking on the road from town C to town B,” to the third statement. The relative terms “larger” and “left” acquire a definite meaning only in conjunction with their appropriate components.

Analogously, the statement, “Someone recognizes something,” demands some such supplement as, “on the basis of a certain fund of knowledge,” or, better, “as a member of a certain cultural environment,” and, best, “in a particular thought style, in a particular thought collective.”

If we define “thought collective” as a *community of persons mutually exchanging ideas or maintaining intellectual interaction, we will find by implication that it also provides the special “carrier” for the historical development of any field of thought, as well as for the given stock of knowledge and level of culture. This we have designated thought style.* The thought collective thus supplies the missing component.

*Contribution of the individual — pp. 40–41:*

Cognition therefore means, primarily, to ascertain those results which must follow, given certain preconditions. The preconditions correspond to active linkages and constitute that portion of cognition belonging to the collective. The constrained results correspond to passive linkages and constitute that which is experienced as objective reality. The act of ascertaining is the contribution of the individual.

The three factors involved in cognition—the individual, the collective, and objective reality (that which is to be known)—do not signify metaphysical entities; they too can be investigated, for they have further relations with respect to one another.

These further relations consist in the facts that, on the one hand, the collective is composed of individuals and that, on the other, objective reality can be resolved into historical sequences of ideas belonging to the collective. It is therefore possible from the viewpoint of comparative epistemology to eliminate one or perhaps even two factors.

Although the thought collective consists of individuals, it is not simply the aggregate sum of them. The individual within the collective is never, or hardly ever, conscious of the prevailing thought style, which almost always exerts an absolutely compulsive force upon his thinking and with which it is not possible to be at variance.

*Minimum thought collective — pp. 43–44:*

A kind of superstitious fear prevents us from attributing that which is the most intimate part of human personality, namely the thought process, also to a collective. A thought collective exists wherever two or more people are actually exchanging thoughts. He is a poor observer who does not notice that a stimulating conversation between two persons soon creates a condition in which each utters thoughts he would not have been able to produce either by himself or in different company. A special mood arises, which would not otherwise affect either partner of the conversation but almost always returns whenever these persons meet again. Prolonged duration of this state produces, from common understanding and mutual misunderstanding, a thought structure that belongs to neither of them alone but nevertheless is not at all without meaning. Who is its carrier and who its originator? It is neither more nor less than the small collective of two persons. If a third person joins in, a new collective arises. The previous mood will dissolve and with it the special creative force of the former small collective.

We could agree with anybody who calls the thought collective fictitious and the personification of a common result produced by interaction. But what is any personality if not the personification of many different momentary personalities and their common psychological Gestalt? A thought collective, by analogy, is composed of different individuals and also has its special rules of behavior and its special psychological form. As an entity it is even more stable and consistent than the so-called individual, who always consists of contradictory drives.

A moral? Even as little as two students at Columbine High School in Littleton, Colorado can form a thought collective. And indeed they did: look at the drastic reality they were able to create (destroy).

*Stability of reality — pp. 46–47:*

Gumplowicz expressed himself very poignantly on the importance of the collective. “The greatest error of individualistic psychology is the assumption that a *person* thinks. This leads to a continual search for the source of thought within the individual himself and for the reasons why he thinks in a particular way and not in any other. Theologians and philosophers contemplate this problem, even offer advice on how one ought to think. But this is a chain of errors. What actually thinks within a person is not the individual himself but his social community. The source of his thinking is not within himself but is to be found in his social environment and in the very social atmosphere he ‘breathes.’ His mind is structured, and necessarily so, under the influence of this ever-present social environment, and *he cannot think in any other way.*”

Jerusalem dealt with this problem in a number of essays, the last of them bearing the apposite title “Social Conditioning of Thinking and of Thought Patterns.” “Kant’s firm belief in a timeless, completely immutable logical structure of our reason, a belief that has since become the common heritage of all who adopt an a priori point of view and is maintained with great tenacity also by the latest representatives of this direction of thinking, has not only failed to be confirmed by the results of modern ethnology but proved to be definitely erroneous.” “The primitive individual feels himself only a member of his tribe and clings to its traditional way of interpreting sensory perceptions with absolutely incredible tenacity.” “I have no doubt, and it is confirmed through the diverse institutions found in primitive societies, that tribesmen reinforce each other’s belief in the ubiquity of spirits and demons, which is already sufficient to give these figments of the imagination some degree of reality and stability. This process of mutual corroboration is by no means confined exclusively to primitive societies. It is rather prevalent today, fully effective in our everyday lives. I wish to designate this process and any structure of belief formed and fortified by it *social consolidation.*” “Even particular and objective observations . . . require confirmation by the observation of others. Only then will they become common property and thus suitable for practical utilization. Social consolidation functions actively even in science. This is seen particularly clearly in the resistance which as a rule is encountered by new directions of thought.”

*Stability of reality — pp. 99:*

Because it belongs to a community, the thought style of the collective undergoes social reinforcement, as will shortly be discussed. Such reinforcement is a feature of all social structures. The thought style is subject to independent development for generations. It constrains the individual by determining “what can be thought in no other way.” Whole eras will then be ruled by this thought constraint. Heretics who do not share this collective mood and are rated as criminals by the collective will be burned at the stake until a different mood creates a different thought style and different valuation.

*Stability of reality — p. 102:*

The fact thus defined as a “signal of resistance by the thought collective” contains the entire scale of possible kinds of ascertainment, from a child’s cry of pain after he has bumped into something hard, to a sick person’s hallucinations, to the complex system of science.

Facts are never completely independent of each other. They occur either as more or less connected mixtures of separate signals, or as a system of knowledge obeying its own laws. As a result, every fact reacts upon many others. Every change and every discovery has an effect on a terrain that is virtually limitless. It is characteristic of advanced knowledge, matured into a coherent system, that each new fact harmoniously—though ever so slightly—changes all earlier facts. Here every discovery is actually a re-creation of the whole world as construed by a thought collective.

A universally interconnected system of facts is thus formed, maintaining its balance through continuous interaction. This interwoven texture bestows solidity and tenacity upon the “world of facts” and creates a feeling both of fixed reality and of the independent existence of the universe. The less interconnected the system of knowledge, the more magical it appears and the less stable and more miracle-prone is its reality, always in accordance with the thought style of the collective.

This issue about community-created realities—from whence comes their stability—used to be on my mind a lot. Let me throw in at this point a little essay I wrote my friend Greg Comer way back (28 March 1993). I think it is quite in line with much of what Fleck is saying:

#### Insights from Cuero

I login to the computer only to find an “empty tray” representing the status of my new electronic mail. Woe is me. You know it is the mail that makes me live and thrive.

I wonder how close I really am to getting this idea of the quantum straight. Sometimes I think I’m very close and then at others (like today) I feel completely lost. And it’s you that gets to hear about all this over and over.

I wish I could fill your ears with the technical details of how to “derive” the quantum from a few simple desiderata for LWL. But I can’t and that’s nothing new. So to fill my time and make my fingers tired I plan to fill this note with pure unadulterated philosophy . . . Insights from Cuero. There’ll be no hint of real science here; I make no apologies.

From where and of what utility comes this notion of an “objective world” independent of man, woman, animal, and plant? My opinion is that (in the end) “objective reality” is posited for nothing more than to have a device for coordinating the various experiences common to all those who communicate. Mark Twain once wrote, “If you tell the truth, you don’t have to remember anything.” It seems to me that that pretty much sums it up. The objective truth saves us from having to make sure that the stories we tell are consistent; it saves us from having to remember all aspects of the past. It gives us a means for determining whether someone’s behavior is insane. It gives us a means by which to determine the guilt or innocence of an accused murderer. Is there any other real motivation for positing an objective reality? I can think of none . . . but why should I, the reason listed above should be powerful enough argumentation for anyone involved in the sciences.

Nevertheless, just how essential is this notion of an objective reality? The “idealists” have been trying to do away with it since the days of Bishop George Berkeley. “Esse est percipi.” Why be fixated on a “material reality” that can never be confirmed; all that is truly available to our discerning is our thoughts and our sense impressions. As far as thinking beings are concerned, material/objective reality is a mental construct . . . whether it is indeed ultimately “out there” or not. So just do

away with it; superfluosity. All that is really needed to make sense of this world is “mind.”

Cute idea, I say. But what a strain when the so much simpler picture of “objective reality” will do. This is the side of the razor I’d put Ockham on if I could. Mais, c’est un monde que je ne vois pas.

The problem we face in modern times is that the existence of quantum phenomena seems to cry out for the relinquishing of this objective reality notion. How else can we consolidate the experimentally confirmed violation of the Bell inequalities with the equally well experimentally confirmed Lorentz character of spacetime? (Well, of course, there are ways . . . if one is of such a mind. Bohm’s 1952 nonlocal hidden variable theory, for instance, is a step in that direction. Or at worst, one could say that Allah wills each and every quantum mechanical measurement outcome. But what a price these both are to pay. In the first case, one relinquishes simplicity in the equations. In the second, one relinquishes science and reasoned philosophy.) The case in the end seems to be that quantum mechanical systems have properties only insofar as those properties are *created* by (freely-chosen) human “measurements.”

So what are we left with? Either we decide it’s simpler to work on some muck like the Bohm hidden variable theory to save objective reality . . . risking the simplicity of the best physical theory we’ve yet constructed, not to mention the fact that so far it has seemed to lead to no new physics. Or we decide it’s simpler to work out how our experiences can be coordinated without an objective reality. You know which way I lean.

But how can we easily get by with simply “consistency” and “coordination” for our “community of communicators” instead of “reality?” From where now can we pull a man-independent notion of consistency? The answer must be “nowhere.” We are left with pulling it from the community itself. And it is of course this very fact that worries us—the individual and community opinions being demonstrably (through standard interpersonal relations and history) so *damned* fluid. You asked a few days ago:

People are different, so surely the rules must constantly change, even if slightly. This is what troubles me these days: the rules must constantly change. . . . If there are no laws, then how can we count on the permanence of anything, especially the requirement of “consistent”? . . . But if people are truly different how can nature be consistent?

No answers today, of course, but maybe some hints: force and diplomacy.

Sometime around the year 1985 or 1986, I was walking across the University of Texas campus . . . from the Student Union (I think) to the Perry-Casteñada Library. On the South Mall between the UT Tower and the TX State Capital, I approached a man talking to himself fairly audibly walking in the same direction as myself. I slid up behind him as closely as I could without being detected and tried to listen in on the conversation. (He did, by the way, later notice me . . . and I became scared stiff as he subsequently followed me all the way into the library!) Sure enough, the conversation seemed, as far as I could tell, like any other conversation one might hear on a Sunday dusk . . . only one could not hear or see the second participant. (The day, by the way, was indeed Sunday.) This caused pause for a lot of reflection in that short time . . . and consequently over the years.

The first thought, of course, was that the man was crazy. There was no one else there for him to talk to. But then I started thinking about what might happen if I

were to confront him with this observation. One possibility that occurred to me was that he would look at me, tell me I was “crazy”, and introduce his friend Joe (for instance). At that point, given exactly that situation, how on earth would I really know that it was he and not I that was crazy? Of course, by nature, I would have to believe that it was he that was insane, but how could I really prove to myself that that was the case? It dawned on me that I needed only to find a passerby to confirm my opinion. But what if our man of interest said, “You’re both crazy. Can’t you see my friend? This is the strangest thing I’ve ever encountered; two crazies at one time.”??? How could we know that we weren’t both crazy? Well, in the same vein, we could just ask for confirmation of the man’s insanity from a third person; then we would feel quite confident, wouldn’t we? Yeah, we probably would, but this is now a question of principle. What if the man said, “All three of you are crazy as birds. My friend Joe is here as plain as day. Joe, we need to call the authorities about these people. You heard what I heard didn’t you? I thought you did. Yeah, that’s a good idea; you run off to the library. There’s a phone there.” Just what if? Then we would have to pull in a fourth person for that extra bit of confirmation to assure ourselves of our own sanity. And so on the story could go.

What is the point of all this? Without an objective reality underlying our experiences, even one bad seed can destroy the possibility of a comfortable background for their coordination. We can never be sure that that one “crazy” man is not in fact sane and we, on the other hand, are all insane. This tells us that questions of principle—to some extent—go down the tubes when the notion of objective reality is wiped from our repertoire of physical concepts. That said, though, what would happen *in practice* in a scenario like that described above? Easy. The singular man would be locked away in some asylum in San Antonio, TX. Majority rules . . . or those with power rule . . . or the ruling class rules . . . or . . . . The point is some faction makes the rules, and those rules are enforced. It is this enforcing that gives a certain uniformity to our existence. Any unbearable non-conformity is either isolated or destroyed.

Before we run with this idea a little further, let’s take a look at a slightly more difficult case. Consider the events that have been taking place in Waco, TX the last few weeks. There a cult leader, David Koresh, has declared himself Jesus Christ. He and his following (originally over 100 strong) have blockaded themselves along with quite a bit of firepower within some compound either near or in the city. At least six or so people have been killed in the ensuing struggle. Can we consider these hundred people sane? I would say, “no!” One would think they would surely sense the consequences of their actions . . . if they were sane. They will eventually lose; they will all eventually be arrested or killed. There is no doubt about this . . . *to all of us who observe from the outside*. From the “inside”, though, it must be a completely different story: David Koresh *is* Jesus Christ; God *will* save them; killing others *is* justified. By any standard criterion of insanity, this must be a “mass insanity.” (In perhaps different words, many of the convicted will probably plead this when trial comes.) No longer here are we isolated to a *single* man doing crazy things; now it is a mass of 100 people. [Of special interest, I find it particularly enlightening that Koresh’s right-hand man is a “Harvard educated lawyer.” !!! This is just a hint of what we know must eventually be the case in this observer created reality we are trying to investigate. “Rational powers of thought” (as exhibited by the LSAT score required for Harvard) must have nothing to do with anything in the end. Reality is defined by the community. Period.] The point now: be it the

insanity of one or a hundred, the faction making the rules will snuff that insanity out in one of the ways listed above.

Now let's carry this to the extreme. What of Germany in 1941, perhaps at the peak of its Nazi prowess? It very well could have easily become the "faction making the rules." And then it would have enforced those rules. Surely an insane faction by present-day standards! But if it had become the ruling faction, it is our present-day notions that would be insane. This is what we have to gulp in our picture of a reality created by the community of communicators—not only for social interactions but for the "physical world."

Just in summary let me reiterate this small insight or missing link: Not only is reality created by the community, but also *enforced* by the community. It is this enforcing that gives a certain uniformity to our existence and ultimately circumscribes any good notion of "consistency."

How formal this notion can be made, I'm not sure. I don't even want to contemplate it now. What I'd like to do in the remainder of this note is briefly sketch the importance of Wheeler's phrase: "The past exists only insofar as it is recorded in the present." Lately here in Albuquerque we have been a little worried about the problem of the arrow of time and its relation to the Second Law of Thermodynamics. I've told you this before. David Wolpert asks, "Why can we only remember the past and not the future given that all physical laws are time symmetric?" If we take Wheeler's standpoint, this is not a problem at all but a tautology, a triviality. For what is in memory is, by definition, "the past." The past has no existence otherwise. It too is not simply something "out there" independent of man, woman, animal and plant. This point we can use to tie together a loose string in our discussion.

If a ruling faction enforces a certain uniformity and consistency in the present, then by Wheeler's maxim, it also enforces that same uniformity and consistency in the past. You ask how can "consistency" be stable? Well here's the direction of an answer . . . if we take all this seriously. The present makes the past and thus the continuity of all its policies with those of the past . . . including the continuity of physical law. Perhaps there is a bit more than social commentary to be learned from George Orwell's novel *1984*! Recall how history was constantly being rewritten in that novel by an official government agency. Any dissenters from the official account were snuffed out. No less can we expect in our account of physical law.

This ends our tale so far. Please, please recall though that I warned you that this note would contain only pure unadulterated philosophy. Not a bit of science. So I expect no less than a million loopholes in these thoughts. Nevertheless I hope there is at least something worthwhile in here.

Does this tell you that I have been inclined to the idea of the *Denkkollektiv* for a long, long time? Notice again, though, that my motivation came largely from quantum mechanics.

*Requirement that there be a community — p. 174 (note from p. 49):*

But we soon read: "Not every observation by an individual must in itself be valued as an experience. Only after a stock of general and well-confirmed knowledge has formed as a result of mutual agreement and reinforcement in the course of continued cooperation of the intellects involved should we speak of experience. General and well-confirmed experience, however, must be considered the sole criterion of truth." Confrontation of these contradictions does not constitute a criticism of Jerusalem. It merely exemplifies that when new thought styles are evolving,

contradictions sets in as an expression of the intellectual “contest of the fields of view.”

*French bread — p. 50:*

What is the reason for this special position of current scientific statements as required by the philosophers just quoted?

They believe that our present-day scientific opinions are in complete contrast with all other ways of thinking. As if we had become wise and our eyes had been opened, they believe that we have simply discarded the naive self-consciousness of thought processes which are primitive or archaic. We are supposedly in possession of “correct thinking” and “correct observation,” and therefore what we declare to be true *is ipso facto true*. What those others such as the primitives, the old people, the mentally ill, or the children declare to be true *seems to be true only to them*. This arch-naive view, which prevents the building up of a scientific epistemology, reminds us very much of the theory of a French philologist of the eighteenth century who claimed that *pain, sitos, bread, Brot, panis* were arbitrary, different descriptions of the same thing. The difference between French and other languages, according to this theory, consisted in the fact that what is called bread in French really was bread.

*Connection to Wheeler’s “Law without Law” — p. 51:*

The views outlined here should not be construed as skepticism. We are certainly capable of knowing a great deal. If we cannot know “everything,” according to the traditional position, it is simply because we cannot do much with the term “everything,” for every new finding raises at least *one* new problem: namely an investigation of what has just been found. The number of problems to be solved thus becomes infinite and the term “everything” meaningless.

An “ultimate” or set of fundamental first principles from which such findings could be logically constructed is just as nonexistent as this “everything.” Knowledge, after all, does not repose upon some substratum. Only through continual movement and interaction can that drive be maintained which yields ideas and truths.

I find this passage greatly reminiscent of David Deutsch’s description of John Wheeler’s idea of “law without law” [D. Deutsch, “On Wheeler’s notion of ‘Law without Law’ in Physics,” *Found. Phys.* **16**, 565–572 (1986)]. Deutsch wrote:

Is it possible that there is an ultimate law of physics, a principle  $\mathcal{P}$  from which follows everything that is knowable about the material world? If so, what can we already infer or postulate about the form that this principle takes? Wheeler’s idea of “law without law” is an attempt to begin to answer these questions.

If there were no all-explanatory physical principle  $\mathcal{P}$  approachable by the methods of science, this would presumably mean that there exist aspects of the natural world that are fundamentally inaccessible to science. This would run directly counter to rationalism and to our view of physics as the universal science, which have hitherto been the driving forces behind progress in the subject and which we should be extremely reluctant to abandon.

But if  $\mathcal{P}$  were itself a law of physics, then the problem of  $\mathcal{P}$ ’s own origin—why that particular principle holds in nature rather than some other—would be forever insoluble. And hence  $\mathcal{P}$  would not be all-explanatory within physics. So,

paradoxically  $\mathcal{P}$ , the ultimate principle of physics, cannot be a “law” (of physics). Hence the expression “law without law.”

Honestly, though, I’m not sure to what extent Wheeler really saw this argument as his own motivation: it might just be a case of Deutsch looking at Wheeler through Oxford-colored glasses. I don’t recall ever seeing Wheeler write the argument himself. Instead, it seems that his motivation for “law without law” had been that every law he had ever seen formulated had ultimately been “transcended.” This itself built a bit of scepticism. But then on top of that was quantum mechanics with its random measurement outcomes, “each individual one shunning all law.”

*What is truth? — p. 100:*

A historical connection thus arises between thought styles. In the development of ideas, primitive pre-ideas often lead continuously to modern scientific concepts. Because such ideational developments form multiple ties with one another and are always related to the entire fund of knowledge of the thought collective, their actual expression in each particular case receives the imprint of uniqueness characteristic of a historic event. It is, for instance, possible to trace the development of the idea of an infectious disease from a primitive belief in demons, through the idea of a disease miasma, to the theory of the pathogenic agent. As we have already hinted, even this latter theory is already close to extinction. But while it lasted, only one solution to any given problem conformed to that style. . . . *Such a stylized solution, and there is always only one, is called truth.* Truth is not “relative” and certainly not “subjective” in the popular sense of the word. It is always, or almost always, completely determined within a thought style. One can never say that the same thought is true for A and false for B. If A and B belong to the same thought collective, the thought will be either true or false for both. But if they belong to different thought collectives, it will just *not* be *the same* thought! It must either be unclear to, or be understood differently by, one of them. Truth is not a convention, *but rather (1) in historical perspective, an event in the history of thought, (2) in its contemporary context, stylized thought constraint.*

This is a wild idea, but notice how the sum total of thought collectives almost hints of a “partial Boolean algebra” structure. That is to say, the set of thought collectives looks a little like a Hilbert space: the set of propositions concerning a quantum system can be viewed as a collection of “local” Boolean algebras with a certain “pasting” condition for connecting them together—in total one gets a so-called Boolean manifold. So too, it might be the case with thought collectives.

*Fact as thought-collective resistance — p. 101–102:*

In the field of cognition, *the signal of resistance* opposing free, arbitrary thinking is called a *fact*. This notice of resistance merits the adjective “thought collective,” because every fact bears three different relations to a thought collective: (1) *Every fact must be in line with the intellectual interests of its thought collective*, since resistance is possible only where there is striving toward a goal. Facts in aesthetics or jurisprudence are thus rarely facts for science. (2) *The resistance must be effective within the thought collective. It must be brought home to each member as both a thought constraint and a form to be directly experienced.* In cognition this appears as the connection between phenomena which can never be severed within the collective. This linkage seems to be truth and conditioned only by logic and content. Only an

investigation in comparative epistemology, or a simple comparison after a change has occurred in the thought style, can make these inevitable connections accessible to scientific treatment. The principle of immutability of species characteristics was valid for classical bacteriology, according to the interpretation of the time. If a scientist of that time had been asked why the principle was accepted or why the characteristics of species were conceived in this way, he could only have answered, "Because it is true." Only after a change in thought style did we learned that the opinion was constrained mainly by the methods applied. The passive linkage between these principles was transformed into an active one. (3) *The fact must be expressed in the style of the thought collective.*

*Objects created by thought — p. 181:*

The boundary line between that which is thought and that which is taken to exist is too narrowly drawn. Thinking must be accorded a certain power to create objects, and objects must be construed as originating in thinking; but, of course, only if it is the style-permeated thinking of a collective.

*How to use philosophical principles — p. 181:*

... philosophical principles are like money. They are very good servants but very bad masters. Principles should be made use of, but not blindly accepted as guides.

*Symbols — p. 125:*

This is how chemistry was described before it entered the modern age. Such mystical allegories and comparisons and the strongly emotional images exhale an atmosphere that is completely alien to our scientific thinking. The comparison of gold with the sun and of silver with the moon survives only in popular imagination. Associating lead with Saturn and tin with the devil has lost all meaning even in popular thinking. It is a special, self-contained style, consistent from its point of view. Those people thought and saw differently than we do. They accepted certain symbols that to us appear fanciful and contrived. What if we can present our symbols—the potential, or physical constants, or the gene of heredity, etc.—to thinkers of the Middle Ages? Could we expect them to be delighted with the "correctness" of the symbols and instantly listen to reason? Or, conversely, would they find our symbolism just as fanciful, contrived, and arbitrarily devised as we find theirs?

*Name as a property — p. 136:*

A name here has a completely different significance from what it has today. It is not an arbitrary, conventional designation or one that arose by historical accident. The meaning is inherent in the name, and its investigation constitutes an integral part of acquiring knowledge about what it names. The name ranks as a property of its object of reference.

*Meaning as a property of the object — p. 137:*

We are thus confronted with ideograms, or graphic representations of certain ideas and certain meanings. It involves a kind of comprehending where the meaning is represented as a property of the object illustrated.

## The Denkkollektiv and the Quantum

The Denkkollektiv, what do I make of it? Something about it sounds so nice and right, but still I worry. Let me try to make much clearer what I already tried to express to you in the old letter of October 1995.

The essential point of Fleck, as I see it, is that science never grasps the *actual* “thing in itself.” The most science can do is toy with the “things in themselves” that it itself constructs—that is, as part of a community-oriented project to grasp and codify the world. With this, I am inclined to believe. But still one can ask, is there an actual thing in itself, the measly idea of which can at least be abstracted from the phenomena we observe? Could it be that science, despite its socially constructed character, is steadily (or even jerkily) moving toward being a better and better reflection of *what is* (i.e., that which was there prior to our attempts to understand it)? As far as I can recall, Fleck gave no sound argument for why that *could not* be the case. As far as I can tell, nothing about Fleck’s system would crumble if underneath it all there really were a “real world” that science might or might not grasp. Of course, the scientist may never know that he is there, but that doesn’t preclude the existence of such a substrate.

This contrasts with the world indicated by quantum mechanics. It is a world so sensitive to the touch that the most natural understanding of it may **only** come about via Fleckian lines of thought. This is my present feeling. And this is what I was trying to express in the note I forwarded to you titled “Fuchsian Genesis” (it was attached to the bottom of a note titled “Genetic Genesis.”)

Charlie Bennett might say, “Of course, there’s a reality out there. That’s what gives the scientist a reason to be.” But maybe there isn’t: the quantum points in just that direction. Quantum mechanics teaches us that the questions we can ask of the world have this wonderful non-Boolean property: I can ask a question  $X$  or a question  $Y$ , but there’s no good sense in which I can ask the question  $X \wedge Y$ . Thus my free will (and your free will) play a fundamental role in the evidence we amass for our world picture, and necessarily so. This in turn also makes the Denkkollektiv more fundamental than one might have thought. It is not the case that if we as scientists cleaned up our act sufficiently well, we might find ourselves sitting atop that hallowed edifice called reality.

The reality we have is in nonnegligible part the one we create. And, it seems to me, there is no reasonable way of getting around that when—but only when—quantum phenomena are recognized as part of the world.

## 15 May 1999, “Tsk, Tsk”

Almost like I was 28 years younger, I bounded out of bed this morning with this greatest of glee! But this time it wasn’t for the Saturday morning cartoons, no. Somehow I was sure that today you would surprise me with some meaty philosophical speculation about the realities we create—a report on the connections between your thought, my thought, and Mr. Bennett’s. I opened my mailbox in childlike anticipation . . . . and then . . . slowly . . . . sulked back to bed. There was no more comfort than the protection of the sheets over my head. The world was left better unfaced.

## 22 May 1999, “Reality in Lottery”

Kiki told me you called. Sorry I haven’t gotten back in touch with you; lots of things have been going on this week, and I’ve hardly had a chance to get any email done. If you’d still like to talk, give me a call Saturday. Or if you want, I can call you Sunday (when rates are significantly cheaper for us). Let me know (when I should be listening for the phone or commanding its dial).

In the mean time, have a look at what I swiped from the New York Times this morning. It’s from an article titled “Living Off the Daily Dream of Winning a Lottery Prize.” Would you call that reality creation? Would you say Newsome lives in one Denkkollektiv, while the writer of the article lives in another?

Newsome, who works at a nearby powder-coating plant, applying protective coatings to metal products, has developed his own system of tracking past winning numbers to determine patterns. In a ritual that is performed in the family’s house each morning, Newsome rises at 4:30 a.m., puts on his robe and walks downstairs to the kitchen.

After turning on a pot of water for his instant coffee, he sits at the table and in front of him he places several memo pads and worn file cards that have hundreds of three-digit numbers written on them.

Painstakingly, Newsome creates charts based on factors like which lottery hostess on television picks the numbers on which day of the week. (A lottery drawing is held every day except Christmas in New Jersey.) Although the drawing is totally random, Newsome is convinced that there is a pattern.

“I see here that 994 has come out three times on Sunday,” he said as he sat down to make his selections one recent Sunday morning. Lighting up a Marlboro 100 and scooping four heaping tablespoons of sugar into a large mug of coffee, he predicted, “I think that 994 is going to come back today.” (It did not.) Based on the information Newsome compiles each morning, he writes down his 20 favorite numbers for the day, and leaves a copy on the table for his wife. She decides which ones she will play.

It is hard to tally how much the Newsomes spend or win, because in addition to the game itself, there is a little gamesmanship between the two. A couple of months ago, Mrs. Newsome played one of the numbers her husband had suggested and she won more than \$300. When Newsome asked her whether she had played it, she told him she had not. “I know he’s hitting a lot of times and ain’t saying nothing to me,” she said.

Last June, according to Newsome’s day planner, the couple won on four consecutive days, for a total of more than \$1,000. “That was a good week,” Newsome said. But throughout most of two months early this year, the Newsomes were playing every day and were not having any luck.

By the middle of one month, Newsome was growing anxious. “We could sure use the money,” he said one evening as he walked up to the counter at Home Dairy and played 172, 578, 198, and 574. (They were all losers; the winning three-digit number that evening was 416.)

## 02 August 1999, “Epiphenomena Chez Dyer”

Thanks so much for the long note about Charlie, Howard, and the other many-worlders. I enjoyed it very much and think we’re finally getting somewhere: the conflicting desires for many-worlds and Copenhagen are rooted in different ideas about the goals of science. That does have a ring of truth, doesn’t it?

I’m sorry to be writing back at such a late date over this. My time in Europe turned out to be much more hectic than I imagined it could be. Actually I started to write you a note on the conversation Chez Dyer over two months ago, just after I got your first long note about it. But for one reason or other I just never finished it. I’ve decided to paste below what *was* written and simply not bother with finishing it. I think the language I was using in that note was a little overblown anyway. Included in that note is a quote of Henry Stapp that I never got to the point of explaining; it’s from his article “Attention, Intention and Will in Quantum Physics” [quant-ph/9905054](#). It is from that article that I snagged the phrase “dangling appendage” as you’ll see momentarily. In general I disagree with almost everything Stapp says, but I thought this quote was noteworthy and quite relevant to our conversation Chez Dyer.

Essentially the thing that struck me at Chez Dyer was the uncanny feeling that all three of us were saying precisely the same thing. But for some reason, Charlie felt that he was saying something different. That confused me greatly and, in fact, still confuses me. In Charlie’s mind, somehow you and I have crossed the bounds of what is real science; somehow he views his language as more neutral (less anthropocentric) than ours . . . and therefore better.

The greatest danger I see in the many-worlds/one-Hilbert-space point of view (beside the ridiculous silliness of it all) is the degree to which it is a dead end. The degree to which it is morally bankrupt. Charlie, by thinking that he has taken some of the anthropocentrism out of the picture, has actually emptied the world of all content.

Beyond that though, I think, many-worlds empties the world of content in a way that’s even worse than classical determinism. Let me explain. In my mind, both completely deterministic ontologies and completely indeterministic ones are equally unpalatable. This is because, in both, all our consciousnesses, all our great works of literature, everything that we know, even the coffee maker in my kitchen, are but dangling appendages, illusions. In the first case, the only truth is the Great Initial Condition. In the second, it is the great “I Am That I Am.” But many-worlds compounds that trouble in a far worse fashion by stripping away even those small corners of mystery. It is a world in which anything goes, and everything does. What could be more empty than that?

My most technical criticism though, is that I don’t see anything in the quantum formalism that compels the many-world point of view. One could have constructed such a free-for-all world in 1884. William James came close:

Indeterminism, on the contrary, says that the parts have a certain amount of loose play on one another, so that the laying down of one of them does not necessarily determine what the others shall be. It admits that possibilities may be in excess of actualities, and that things not yet revealed to our knowledge may really in themselves be ambiguous. Of two alternative futures which we conceive, both may now be really possible; and the one become impossible only at the very moment when the other excludes it by becoming real itself. Indeterminism thus denies the world to be one unbending unit of fact. It says there is a certain ultimate pluralism in it; and, so saying, it corroborates our ordinary unsophisticated view of things. To that view, actualities seem to float in a wider sea of possibilities from out of which they are chosen; and, somewhere, indeterminism says, such possibilities exist, and form a part of the truth.

The only difference between James and many-worlds is that in many-worlds actualities do not float in a WIDER sea of possibilities; the seas are of the same size for they are identified with each other. One could, for instance, take a classical phase space and declare that all initial conditions are equally real and refuse to discriminate between any of the them. Each initial condition is a world, and that is that. Who is to say that one is more real than the other? [[The standard many-worlder usually objects to me at this point by saying something like, “But there is no notion of superposition there!” So I ask, “What does that mean?” and “What role does it play?”: they always fall flat. The reason is they don’t know what role it plays; they likely would have been predisposed to many-worlds even if they had known no quantum mechanics. This is one reason I believe there is a lot of truth in the assessment you gave in the last note.]] If you want to see to what ridiculous ends one can take this point of view—even to the point of completely forgetting about physics when one speaks of the many worlds—have a look at Max Tegmark’s article, “Is ‘the theory of everything’ merely the ultimate ensemble theory?” *Ann. Phys.* **270**, 1–51. You can also find the article on the net at <http://www.sns.ias.edu/~max/toe.html>. I don’t think there is any better technical argument against many worlds than to read this paper (though certainly Mr. Tegmark wouldn’t see it that way!!). Who needs quantum mechanics to have many worlds?

But that’s a little bit of an aside; let me get back to Charlie. The other day he said to me—and this is a direct quote—“It is the fabric of possibilities that is real.” That’s his way of describing the many-worlds point of view. He sees it that the task of science is to delimit what is possible and not go beyond that. Anything beyond that is a kind of religion, or chauvinism as he calls it. There is a way in which I am mildly in agreement with this, but I don’t see any way of grounding the word “possibility” in a way that does not take into account what is “known” . . . and for that one needs a knower (always). The real extent of my mild agreement is that I don’t believe the *actual* outcomes of quantum mechanical experiments, or the mechanism by which they arise, are contained within the structure of the theory: it is a theory of what is possible, nay, probable, but based on what one knows. Wave functions don’t collapse because of any mechanism in the world that changes them abruptly, they collapse when and only when our knowledge changes. [[Can a dog collapse a wave function? Dogs don’t use wave functions. Heck I didn’t collapse a wave function until I was at least 20 years old. We should never confuse the world with what little bit we know of it.]]

It seems to me that there must be a sense in which the world just is—i.e., the sort of thing that Charlie and Howard are striving for—but that way of describing the world is not open to the methods of science. How can one or even a community of observers bootstrap themselves to such a point of view? And indeed even if it could be done, what would it mean for the world that “is” to be nothing more than a list of possibilities without actualities (or, to be more accurate to Charlie’s point of view, a list of possibilities that are all equally actual)? All that is just too high falutin’ for me . . . and as I tried to explain above, simply too empty to be a useful or interesting guide to the world.

The beauty I see in quantum mechanics is precisely the beauty of Copenhagen. As I tried to say it crisply to Bill Wootters the other day: the great lesson of quantum mechanics is that the world can be moved. There is a reason we are stuck with a physics that is “the ability to win a bet” instead a physics that is a static portrait of “what is.” If the world can be moved, we simply can’t ask for more; it would be self contradictory. There has to be some room left within the physical theory; it can’t be a closed book if the book itself isn’t closed.

But I ramble. Let me get back to some of the questions you asked. What should we do with all these ideas? I’m certainly not averse to our writing something together. If we can make the points clearly, it could be a good service to the community. Any more concrete ideas as to how we could go about it? Do you have an outline in mind?

OK, that's enough for now. Ping me your thoughts on all that I said here and I'll pong you back. (Don't forget to look at the further stuff below.)

Below follows the never completed note including the Stapp quote:

---

Thanks again for the long note putting some thoughts in order about the nice conversation we had with Charlie April 4 (Easter).

I think I do agree with you that,

**Herbal Tee 3:** *[I]t seems that there is a great crossroads in the next century, whether we continue as a society to ignore the creation of reality in  $\mathcal{E}$  by science or we choose to use that creativity for good purposes.*

Do you have anything concrete worked out along these lines? Have you written anything expanding upon this sentence? Is there a particular part of Muddling Through that I should take a look at?

Anyway, I thought in this note I'd try to add my two cents to your valiant summary of our discussion chez Dyer. The most important thing I could see, from my perspective, was the unnerving similarity between the following two thoughts (one Charlie's and one mine).

1) Chris: The quantum mechanical formalism does not address a process or mechanism by which the singular, particular measurement outcomes in experiments come about. That aspect of our world is just not contained within the formalism and cannot be, but that is no blemish to the theory.

2) Charlie: The quantum mechanical formalism does not address a process or mechanism by which the singular, particular measurement outcomes in experiments come about. That aspect of our world is just not contained within the formalism and cannot be, but that is no blemish to the theory.

See the difference? If not, then read one more time.

The only great distinction as far as I could tell was in the intonation with which they were presented! Actually, that's an exaggeration, but these sentences did have two vastly different thoughts behind them.

The reason I would say such a sentence (in my intonation) is because it seems clear to me that quantum theory is about and only about our knowledge. It is the best we can say—the most we can predict—about the outcomes of our prodding of the world. It is the best estimate we can give of the world's reaction to our interventions. I don't condemn the weatherman when he knows no physics or chaos theory, when he knows not the details of how rain is actually made; his predictions are useful nonetheless and it is worth my while to pay him for his services. So too, quantum mechanics should not be blamed for not providing the omniscience we have come to expect from classical physics: it cannot predict the outcomes of my prods with complete certainty because the world itself does not know how it will react (nor can it know in advance if or how I will prod). That it gives no mechanism is because it is about our knowledge; that it cannot give a mechanism is because there is none there to be found. "But what about the weatherman? We can imagine one that is infinitely good, can't we? One that is on the mark each and every time? This says your assessment of quantum theory need not be correct." Well, we can imagine unicorns too. Just because a theory is about knowledge, it does not automatically mean that it can be improved. (And that statement need not be a renunciation of the goals of science.)

A controversy is raging today about the power of our minds. Intuitively we know that our conscious thoughts can guide our actions. Yet the chief philosophies

of our time proclaim, in the name of science, that we are mechanical systems governed, fundamentally, entirely by impersonal laws that operate at the level of our microscopic constituents.

The question of the nature of the relationship between conscious thoughts and physical actions is called the mind-body problem. Old as philosophy itself it was brought to its present form by the rise, during the seventeenth century, of what is called ‘modern science’. [...] The central idea is that the physical universe is composed of “material” parts that are localizable in tiny regions, and that all motion of matter is completely determined by matter alone, via local universal laws. This *local* character of the laws is crucial. It means that each tiny localized part responds only to the states of its immediate neighbors: each local part “feels” or “knows about” nothing outside its immediate microscopic neighborhood. Thus the evolution of the physical universe, and of every system within the physical universe, is governed by a vast collection of local processes, each of which is ‘myopic’ in the sense that it ‘sees’ only its immediate neighbors.

The problem is that if this causal structure indeed holds then there is no need for our human feelings and knowings. These experiential qualities clearly correspond to large-scale properties of our brains. But if the entire causal process is already completely determined by the ‘myopic’ process postulated by classical physical theory, then there is nothing for any unified graspings of large-scale properties to do. Indeed, there is nothing that they *can* do that is not already done by the myopic processes. Our conscious thoughts thus become prisoners of impersonal microscopic processes: we are, according to this “scientific” view, mechanical robots, with a mysterious dangling appendage, a stream of conscious thoughts that can grasp large-scale properties as wholes, but exert, as a consequence of these graspings, nothing not done already by the microscopic constituents.

## 17 August 1999, “A Bernstein Off the Earth?”

Where’ve you been? Did you fall off the world? Most importantly, did you get the long note I wrote you a couple of weeks ago concerning THE conversation chez Dyer? I think it’s my best attempt yet to pin down what I hate about many-worlds. (It also pins down what I hate about modal interpretations of quantum mechanics.) I would love to hear your comments. Also, I’d be interested in hearing further ideas about our pursuing this issue in the public eye, i.e., by writing some of it down in a paper. (Remember the only rule I have in writing papers is that the author lists be alphabetically ordered.)

I wish you had been at the foundations conference in Maryland last week. In my talk (which I think went quite well this time), I took a strong stance on the interpretation of QM. Namely I stated very explicitly that the most one can hope for in interpreting the state vector is that it corresponds to a state of knowledge. If you use state vectors, you can collapse them; if you don’t, then you can’t. They’re just not physical entities; they don’t exist in and of themselves. In fact I started off the whole talk with a slide of that wonderful quote by Bruno de Finetti (suitably modified to the quantum context):

My thesis, paradoxically, and a little provocatively, but nonetheless genuinely, is simply this:

QUANTUM STATES DO NOT EXIST.

The abandonment of superstitious beliefs about the existence of Phlogiston, the Cosmic Ether, Absolute Space and Time, ..., or Fairies and Witches, was an essential step along the road to scientific thinking. The quantum state, too, if regarded as something endowed with some kind of objective existence, is no less a misleading conception, an illusory attempt to exteriorize or materialize the information we possess. — *the ghost of Bruno de Finetti*

One thing that was really funny was how in conversations, these ideas were referred to variously as “the knowledge interpretation of quantum mechanics” or “Fuchs’s interpretation.” Finally, at the last lunch, just as everyone was parting, I turned to Lucien Hardy and Robert Garisto (an editor at PRL) and said, “You know, I never said this because I knew that I would be able to convey the ideas more effectively if I didn’t ... but the point of view I’ve been advocating is nothing other than the Copenhagen interpretation.”

I had some really superbly productive conversations with Lucien Hardy. If you ever get the chance, get to know him well; he is a scholar in the best sense. I think he’s one of the few already poised to help us stretch and tone our point of view. (He has even admitted that he finds it somewhat attractive.)

Write me some time (soon)!

## 14 September 1999, “A Fleck of Fleck”

This morning while reading Markus Fierz’s book *Girolamo Cardano: 1501–1576, Physician, Natural Philosopher, Mathematician, Astrologer, and Interpreter of Dreams*, I came across a passage of Cardano’s that reminded me of something I had sent you about Fleck. In particular, recall that I was struck by the following two passages in Fleck:

*Name as a property — p. 136:* A name here has a completely different significance from what it has today. It is not an arbitrary, conventional designation or one that arose by historical accident. The meaning is inherent in the name, and its investigation constitutes an integral part of acquiring knowledge about what it names. The name ranks as a property of its object of reference.

and

*Meaning as a property of the object — p. 137:* We are thus confronted with ideograms, or graphic representations of certain ideas and certain meanings. It involves a kind of comprehending where the meaning is represented as a property of the object illustrated.

Fleck was spurred to these passages by a reading of Fontanus’s epitome of Vesalius’s *Anatomy*. I think it was published in 1642.

Anyway it appears that Cardano was already fighting this thought-style when he wrote *De Libris propriis*, ca. 1562. In a passage offering some basic suggestions about how books should be written, Cardano writes:

Pay attention to the things Galen was criticized for, and don’t think that they will bring you praise. Always remember: Words are there to describe things, not things to illustrate words.

I wonder how widespread this practice—the one of Fontanus, i.e., that of thinking of the symbol as a property—was by the time Cardano wrote this? I can tie these thoughts to one other thread by telling you something I read in a paper by Charles Enz [C. P. Enz, “The Wavefunction

of Correlated Quantum Systems as Objects of Reality,” in *Vastakohtien todellisuus: Juhlakirja professori K. V. Laurikainen 80-vuotispäivänä*, edited by U. Ketvel, et al. (Helsinki U. Press, 1996), pp. 61–76.] It has to do with a concept that Pauli called the “idea of the reality of the symbol.” Enz writes,

For a Chinese or a Japanese the reality of symbols is exemplified by the Chinese character representing his name. Indeed for a Chinese *a calligraphic character thus is, after all, like the cipher of his identity*. In the same way as the Chinese characters have to be appreciated not as static pictures but by recreating in one’s mind the dynamics of the calligrapher’s mind, body and brush drawing the successive strokes, the understanding of a specific quantum phenomenon—which, as I tried to show, is most accurately described in terms of the wavefunction  $\psi$ —is a **dynamical process**. This suggests that the quest for quantum reality may be best characterized as **active realism**. Indeed, in order to understand the **symbolism of  $\psi$**  one has to recreate in one’s mind the **properties expressed by  $\psi$**  much in the way Chinese characters have to be read.

I think this is perhaps closely connected to something much more technical I wrote Howard the other day . . . but you can discuss that with Howard.

## 01 September 2000, “The Allure of Texas”

To help answer a question you asked a long time ago. From J. L. Casti, *Paradigms Lost: Images of Man in the Mirror of Science*, (William Morrow and Co., New York, 1989):

Texas may call itself the Lone Star State but Texans have always done things in a big way, so when the agenda item is reality generation no one will be surprised to find that the “lone star” is magically transformed into an entire universe of glowing objects, the centerpiece being nothing less than the meaning of meaning itself. The chief architect of this Texas-sized version of reality is John A. Wheeler, director of the Center for Theoretical Physics at the University of Texas at Austin.

The heart of the Austin Interpretation championed by Wheeler is the idea of a reality created by the observer through exercise of the measurement option. The Austin school believes that we are wrong to think of the past as having a definite existence “out there.” The past exists only insofar as it is present in the records we have today. And the very nature of those records is dictated by the measurement choices we exercised in generating them. Thus, if we chose to measure an electron’s position yesterday in the lab and recorded the resulting observation, then that electron’s position from yesterday exists but its velocity doesn’t. Why not? Simply because we chose to measure the position and not the velocity.

Because this very act of *choosing* is always involved in what we measure, Wheeler feels that the act of observation is “an elementary act of creation.” . . .

We should hasten to note that the Austin Interpretation champions an *observer-created* reality, not a consciousness-created one. The Austin view, while differing from Copenhagen in significant ways, still accepts some of the crucial aspects of Bohr’s position. Most important, the two schools agree that scientists can communicate unambiguously only about the final results of measurement. For Wheeler, the essence of existence (reality) is meaning, and the essence of meaning is communication defined as the joint product of all the evidence available to those who communicate. In this view meaning rests on action, which means decisions, which

in turn force the choice between complementary questions and the distinguishing of answers. Putting all these links together, out pops the Austin Interpretation of reality generation by exercise of the quantum measurement option.

## 09 September 2000, “More Fleckulation”

The “Fleck materials” book is quite nice. There are several articles by Fleck himself, one of them previously unpublished:

- 1) Some Specific Features of the Medical Way of Thinking [1927]
- 2) On the Crisis of ‘Reality’ [1929]
- 3) Scientific Observation and Perception in General [1935]
- 4) The Problem of Epistemology [1936]
- 5) Problems of the Science of Science [1946]
- 6) To Look, To See, To Know [1947]
- 7) Crisis in Science [unpublished, 1960]

It also includes 14 articles about Fleck’s ideas and their context in Polish philosophy. Finally, it contains a full bibliography of Fleck’s writings.

R. S. Cohen and T. Schnelle, *Cognition and Fact: Materials on Ludwik Fleck*, (D. Reidel, Dordrecht, 1986).

You should have a look at it if you get a chance.

## 26 October 2000, “Activating or Catalyzing?”

Thanks a million for the notes! I’ll incorporate them soon.

I’ve had a tremendously difficult time trying to come up with a name for this document. Here are the ones I’ve tried below. Any votes? And please explain why you think what you think.

The Undetached Observer:  
The Activating Observer:  
The Catalyzing Observer:  
The Malleable Reality:  
The Malleable Substrate:

*Resource Material for a Paulian–Wheelerish Conception of Nature*

## 29 November 2000, “Anecdote”

Too bad you’re not coming to Vienna. I’m letting the soul (but not the libido) of Schrödinger slowly seep into me.

Let me tell you a quick anecdote while I have your ear. It’s one you’ll appreciate given your great respect for Ludwik Fleck. I was talking to Experimentalist X the other night, asking him to evaluate his various students so I could tumble over in my head whether any should be approached about employment at Bell Labs. Sadly, one of his students didn’t get the highest of recommendations. The main point was that the student didn’t seem to appreciate the difference

between making an experiment happen and keeping himself/herself busy with work. “If a part doesn’t work, don’t waste time trying to fix it—kill it, and get a new one,” he said. “It can be tough in the lab. It’s almost as if you have to look at your equipment and say, ‘*I will you to work*’. You have to command nature. And Student Y just doesn’t seem to have that.”

Have you ever heard anything more marvelous come directly from the mouth of an experimentalist?

## 17 January 2001, “Up Your . . .”

Alley. Up your alley, Herb.

Have a look at this article:

The Environment and the Epistemological Lesson of Complementarity

Folse HJ

Environmental Ethics 15(4) 345–353 WIN 1993

Document type: Article Language: English Cited References: 23 Times Cited: 1

Abstract: Following discussions by Callicott and Zimmerman, I argue that much of deep ecology’s critique of science is based on an outdated image of natural science. The significance of the quantum revolution for environmental issues does not lie in its alleged intrusion of the subjective consciousness into the physicists’ description of nature. Arguing from the viewpoint of Niels Bohr’s framework of complementarity, I conclude that Bohr’s epistemological lesson teaches that the object of description in physical science must be interaction and that it is now mistaken to imagine that physical science aims to represent nature in terms of properties it possesses apart from interaction.

KeyWords Plus: normative naturalism, intrinsic value, quantum-theory, science

Addresses: Folse HJ, Loyola Univ, Dept Philosophy, 6363 St Charles Ave, New Orleans, LA 70118.

## 05 July 2001 “Par Avion”

I just received your phone reimbursement. Thanks!

And thanks for coming by Charlie’s the other day. What I really need to do the next time I come up, is just spend a day visiting you and visiting ISIS. Would you guys like to hear a talk from me? In fact, Kiki and I didn’t get nearly as much (book) shopping time in as we had hoped to (mostly because of my Hirota duties): So, we might just come for another visit very soon. We’d probably just stay in a hotel in Amherst or Northampton or something to maximize our free time. What’s your summer schedule like? What might be a good time for us to visit?

Charlie dismays me at times, calling my efforts to clean up quantum mechanics “theology.” Strangely, it does hurt—I guess because I respect him so much. For instance, I doubt he’ll even look at my latest paper just because he doesn’t like the goal I have in mind. But there are some meaty theorems there that he might find useful . . . if he wouldn’t just shut himself off to my trains of thought. Getting something like this from Holevo maybe makes it even harder:

I downloaded your recent [arXiv:quant-ph/0106166](https://arxiv.org/abs/quant-ph/0106166). It has several interesting observations, but I like particularly the argument concerning derivation of tensor product of Hilbert spaces from the measurement statistics.

There are two great information theorists in my life, but only one of them will read my papers.

## 29 July 2001, “Sunday Morning, Thinking of You”

Hey old philosophy friend,

I haven’t heard from you in a while. And you never even replied to my last message. So, I wonder whether you got it.

Lately I’ve taken to trying to mix Arthur Schopenhauer, John Dewey and William James into a good quantum stew. I’m certainly getting the feeling that some of their ideas were before their time (and, indeed, a better fit to the quantum world than the classical world of their focus).

But do write me. I am lonely for your company.

## 05 August 2001, “Sunday Morning, Thinking of You, 2”

**Herbal Tee 4:** *ISIS’s fall series is supposed to be about scientific and medical ethics: Can you connect your proposed talk and simplify its level to be appropriate?*

Does that mean there’s an honorarium that comes with giving the talk?

I might be induced to give a William James kind of lecture . . . with a title something like, “Ethics in an Ultimately Lawless World.” Or, “Ethics in a Law-Without-Law World.” Or, “Timeless Ethics in an Evolving Universe?” Use your imagination.

## 08 May 2002, “The Big Eye”

Check out my new paper. It’s titled “Quantum Mechanics as Quantum Information (and only a little more)” and you can find it at my webpage (link below). It’ll also appear on **quant-ph** tomorrow.

I give you and your book with Mike Fortun a little advertisement at the beginning of Section 10.1 and in the Appendix, Point 21.

## 31 October 2005, “QMech Interpretation & Web-Thing Against the War”

Thanks for including me as a recipient on this note, though I’m not quite sure what it’s all about. Did it have something to do with your last lines? To wit,

**Herbal Tee 5:** *What is YOUR best argument for those who take comfort (despite the clear-cut differences between statistical ensemble “lack – of – complete knowledge” kind of probabilities and “complex square roots that superpose” kinds of probability present even in the purest of PURE quantum states)?*

Anyway, just to record one of my latest strivings for clarity: I’ve gotten out of the habit of regarding probability as expressing “lack of complete knowledge.” For that phrase effectively already implies that there’s something out there that the user of the probability just doesn’t have hold of. Instead now, along with de Finetti’s usage, I just think of probability as quantifying “uncertainty” full stop. Uncertainty for whatever reason.

## 13 November 2006, “Zing! Went the Strings of My Heart”

**Herbal Tee 6:** *I had some thoughts about the last (co-authored) paper of yours that you shared; in fact I thought you were letting the pressure of admitting to a classical world get you a bit far over from what we really know we can say. Which is the beauty of Bayesian approaches: sure there is “zing” out there but updating our tables of probabilities and conditionals is about all we know if it.*

*Rather than dig it out and try to get a recollection about the point I’d make, I know you must have at least almost finished the paper if not the negotiations with Carl & whomever, so could you send a newer version to me and my student Zac?*

I’m not sure what you’re saying, but it’s always good to hear from you!

Actually, I’m working all this week to re-edit our paper once again. So any input you might have would be really good. Attached is the version of the paper that arose after David Mermin’s detailed comments. Next, I’ve got to tackle the other three(!) referee reports, and maybe take into account Jerry Finkelstein’s and Chris Timpson’s comments. Why not join the club! It’d be great to hear which parts you think could be made clearer.

## 27 December 2006, “New Year’s Delirium”

Hey Herb, you old reality maker,

I hope you’re having a nice holiday, despite the meanness Charlie and I heaped on you the other day. I’m having a nice time, thinking a lot about what quantum mechanics is trying to tell us, and reading up on F. C. S. Schiller’s flavor of pragmatism. (I’m giving a talk in Paris, Feb 23 at a meeting *Pragmatism and Quantum Meeting*, titled “William James, F. C. S. Schiller, and the Quantum Bayesians”.) Schiller’s ideas are fascinating and I think, perhaps, deeper than James’s even.

Anyway, I was thinking I should send you a holiday letter and I came across a quote today that’s giving me an opportunity. Ultimately, it’s about the “big bang” being right here, right now, all around us. I’ll give you the idea in three flavors, first in the form of a transcribed conversation between John Wheeler and R. Q. Elvee, second in an excerpt from my pseudo-paper “Delirium Quantum” (which is attached in its final form, just sent to the publisher), and third in my newfound quote from Schiller. It comes from his 1924 book, *Problems of Belief*.

Wishing the best to you and your family for the coming year. It sure would be nice to see you again sometime soon. (Will you be going to the Zeilinger foundations meeting in Vienna in June?)

### Flavor 1:

ELVEE: Dr. Wheeler, who was there to observe the universe when it started? Were we there? Or does it only start with our observation? Is the big bang here?

WHEELER: A lovely way to put it—“Is the big bang here?” I can imagine that we will someday have to answer your question with a “yes.” If there is any conclusion that follows more strongly than another about the nature of time from the study of the quantum nature of space and time, it is the circumstance that the very idea of “before” and “after” is in some sense transcended.

There are two aspects of this idea. First, Einstein’s theory of space and time tells us that in order to predict all of space and time for time to come, we have to know

what the conditions of space are now and how fast they're changing. Only then do we have enough information to predict all the future. The uncertainty principle of quantum theory tells us that if we know the condition of space now, we cannot know how fast it's changing. Or if we know how fast it's changing now, we cannot know what the geometry is now. Nature is so built with this complementary feature that we cannot have the information we need to give a deterministic account of space geometry evolving with time.

That deterministic account of space evolving in time is what we mean by space-time. Everything that we say in everyday language, about time is directly built on that concept. And with determinism out, the very ideas of before and after are also out. For practical everyday matters, this indeterminism, this indefinability of spacetime is of no concern. The uncertainties only show up effectively at distances of the order of  $10^{-33}$  cm. Nobody at present has equipment fine enough to reach down to a distance so small.

What does all this have to do with the big bang? At the very beginning of time we know that—according to Einstein's account—the universe was indefinitely small. Things were indefinitely compact. When we talk about time when the universe itself is so fantastically small, we deal with a state of affairs where the very words “before” and “after” lose all meaning. This circumstance puts one heavy restriction on the usefulness of the word “time.” There is another.

When we do our observations in the here and the now on photons, quanta of light, hunks of energy coming from distant astrophysical sources, we ourselves have an irretrievable part in bringing about that which appears to be happening. We can put it this way: that reality is, in a certain sense, made up of a few iron posts of definite observation between which we fill in, by an elaborate work of imagination and theory, all the rest of the construction that we call reality. In other words, we are wrong to think of the past as having a definite existence “out there.” The past only exists insofar as it is present in the records of today. And what those records are is determined by what questions we ask. There is no other history than that. This is the sense in which we ourselves are involved in defining the conditions of individual elementary quantum phenomena way back at the beginning of the big bang.

Each elementary quantum phenomenon is an elementary act of “fact creation.” That is incontestable. But is that the only mechanism needed to create all that is? Is what took place at the big bang the consequence of billions upon billions of these elementary processes, these elementary “acts of observer-participancy,” these quantum phenomena? Have we had the mechanism of creation before our eyes all this time without recognizing the truth? That is the larger question implicit in your comment. Of all the deep questions of our time, I do not know one that is deeper, more exciting, more clearly pregnant with a great advance in our understanding.

## **Flavor 2:**

The way I see it, quantum measurement outcomes are ultimate facts without specific call for further explanation. And indeed the quantum formalism supplies none. Thus there is more to the world than the quantum formalism can supply. Nothing to do with hidden variables. . . .

How does the theory tell us that there is much more to the world than it can say? It tells us that *facts* can be made to come into existence, and not just at some time in the remote past called the “big bang” but here and now, all the time, whenever

an observer sets out to perform (in antiquated language) a quantum measurement. I find that fantastic! And it hints that facts are being created all the time all around us. But that now steps out of the domain of what the quantum formalism is about, and so is the subject of future research. At the present—as a first step—I want rather to make the interpretation of the quantum formalism along these lines absolutely airtight. And then from there we'll better know how to go further.

Doesn't that just make you tingle? That (metaphorically, or maybe not so metaphorically) the big bang is, in part, right here all around us? And that the actions we take are *part* of that creation! At least for me, it makes my life count in a way that I didn't dare dream before I stumbled upon Wheeler, Pauli, and Bell-Kochen-Specker.

### Flavor 3:

On a very minute scale, but in a very real sense, our preferences and our acts are contributing to the shaping of the world, and sharing in the unceasing process of creation, which did not come to an end 5,928 years ago, but is continuously manifested in the all-pervasive creativeness which engenders . . . novelties in every region of the universe.

If Humanism then is right, human agency is *not* the illusion it is so tempting to make it. Truth may be, like the other values, like our moral and aesthetic ideals, a real contribution to reality, which the real might not possess unless we had made it.

## 06 January 2008, “21 Years Ago”

Finally, finally after all these years, I ran across a copy of the book you edited with Marcus Raskin, *New Ways of Knowing*. In it I read your article “Idols of Modern Science”, and as always, felt much in tune with your way of thinking. And you were already thinking those things more than 21 years ago! It was a great article.

Accordingly, I've updated my long-in-the-making document *The Activating Observer* to reflect what I most liked in your article. You can see the result starting on page 9 of the attached (all lovingly typed in with my own two hands). In connection with those passages, you might also enjoy reading or re-reading Pauli's letter to Markus Fierz, dated 10 August 1954, starting on page 96. [See 02-01-06 note “The Oblique Pauli” to H. C. von Baeyer reproduced below.] Pauli's words in that letter are very reminiscent of your own.

Thanks for stimulating my mind once again old friend.

Quotes from:

- H. J. Bernstein, “Idols of Modern Science and the Reconstruction of Knowledge,” in *New Ways of Knowing: The Sciences, Society, and Reconstructive Knowledge*, edited by M. G. Raskin and H. J. Bernstein, (Rowman & Littlefield, Totowa, NJ, 1987), pp. 37–68.

In their quest to extract consistency from nature, scientists relentlessly pursue very particular and specialized knowledge.

and

As a physicist, I began this essay with critical self-examination of science as a particular form of organized human behavior. In this light, one aspect stands pre-eminent. The scientific study of the world upholds experience as the final arbiter

of knowledge. Not any experience, but only the specially controlled and pre-conditioned experience of experiment. Science entails as much creativity, originality, and as many “free inventions of the human spirit” as other intellectual activities (like art, poetry, philosophy, or social studies), but always inventions which can be checked against the experience of nature; not direct, emotional experience like smelling a rose or hiking to exhaustion in the High Sierras or “psyching out” the answer by intuition, but rather as stylized, conventionalized and, indeed, bizarre behavior which traps nature and emphasizes its regularity. Think of the most ordinary scientific operation, such as finding the length of this page with a ruler. You use an instrument of great complexity, with a straight edge supplied by a brass strip held in the fine groove of a specially stamped and printed piece of wood, calibrated against an arbitrary standard. For more detailed knowledge of the world, science obviously goes beyond the simple rule, but note how value-laden even that device is: could any but an industrialized and commercialized society provide so many millions of brass and wooden copies of a central arbitrary definition of length, or the training and attitudes needed to use it correctly?

and

Physics shows as much variety and method as any science. Indeed, the first attack on a new problem is to try all the tricks that previously worked; conversely, every new trick is quickly applied to all the currently interesting problems if it succeeds on any one of them. There are always new techniques and new approaches being invented. But some form of mathematics always appears, so we might attempt to deduce a general method from this fact. At least one eminent theoretical physicist, Eugene Wigner, has marveled at the “unreasonable effectiveness” of mathematics very extensively, and that mathematical elegance and newly created mathematics are often guides to new physical theories. It is as if Nature herself were secretly, somehow, mathematical . . . and man’s creation of mathematics mimics nature’s creation of phenomena.

But from the present point of view, it is rather bizarre behavior of experiment which projects consistency onto nature. We are, in effect, making phenomena appear rational for our own intellectual and emotional pleasure. Current scientific data are the result of manipulations of natural objects with the specifically numerical outcome of measurement. While doing scientific experiments we do not assemble those rare substances and produce those unusual conditions in order to “groove on the vibrations.” Men’s and women’s minds invent facts of science through their intellectualized, and mathematized, perceptions of phenomena. It is not at all surprising that the highly similar invention of mathematics—with its emotional, nonrational, and unconscious motivation, its own search for consistency as opposed to Truth, and its insistence on producing a rational outcome—has great power and relevance in science. Out of the vast range our minds possess, mathematics and science seem to have tapped the self-same mode.

Asking why the world turns out to be so mathematical is almost like wondering how vegetables come to be so well-suited to feeding animals. Nature’s construction of all the organic forms (we now know) is of a piece; of all the various ways to combine elements of earth, only certain carbon-based molecules, controlled by extraordinarily similar genetic codes, form the compounds of all life. Compatibility is no mystery. What sunlight streaming through the biosphere has done for animals and plants, nonrational inspirations flowing into the human mind have done

for science and mathematics. What seems most marvelous in this is the “unreasonable effectiveness” of emotions in producing rationality both in mathematics and in physics.

and

To Einstein, the good of physics resided precisely in its objective ability to comprehend reality, not to manipulate it. Only contemplative rationality could serve the morally commendable goal of pure knowledge. In the light of Forman’s analysis, Einstein’s choice was to reject the standard science, with its hidden acceptance of political pressure, in favor of older values of objective realism. He would not have put it this way; he did not identify the Copenhagen (acausal) interpretation with world politics, but simply with an epistemological error in science itself—namely, confusing study of what we know with a study of what actually is. But most physicists could conveniently relegate such issues to philosophy. They substituted their own construction, knowledge of the universe, in the place of the real world itself as object of investigation *without* taking full responsibility for the power of making real that which they would choose to know. The quantum physicists hoped to banish unverifiable analogies and fictions. But moral visions are also fictions, images, and analogies. In bypassing them (as in ignoring the question of *what* to make real) they excluded this whole realm of thought. Without addressing any moral implications, they took quantum mechanics and its interpretation as the very definition of disciplinary excellence.

The consequent events were extraordinary. Quick to apply the “best” new theories to nuclear puzzles (once they solved those of atomic electrons), physicist hurtled us willy-nilly into a new age, fraught with powerful new dangers. In 1928, barely two years after Born invented the statistical interpretation, Gamow applied quantum mechanics to nuclear physics; in fact, his data on alpha decay happened to start from Uranium-238. In the thirties, experimentalists discovered fission, presaging nuclear energy; the Manhattan Project, triggered by a letter from Einstein to Roosevelt, eventually made World War II our first nuclear war.

and

In the case of quantum mechanics, the defining shift from “it explains” of classical physics to “it works” inspired a different sort of debate. For many years Einstein argued that quantum mechanics was physically incomplete, that there were elements of physical reality which it could not represent. Bohr argued that only the actual results of experiments could be considered real—and these results all obey the probabilities given by quantum mechanics. Both Bohr and Einstein realized that physics had discovered a limit to its own knowledge of reality. Neither of them realized that this limit posed questions of moral dimensions: not whether we were slipping from an old morality of objective (and omniscient) knowledge but new questions, questions about knowledge that works: “Works for what?” “For whom?” “Knowledge to what end?”

All of these questions arise because the quantum revolution entailed not merely abandoning a priori definitions of reality (upon which Einstein seemed to insist) but adopting a new direction of gaze as well—one which is self-reflexive of the fact that it involves a choice. Jauch compares the phenomena of nature to random messages, waiting to be deciphered by scientists:

But since the code is not absolute, there may be several messages in the same raw material of the data, so changing the code will result in a message of equally deep significance in something that was merely noise before and *conversely*: In a new code a former message may be devoid of meaning. Thus a code presupposes a free choice among different, complementary aspects, each of which has equal claim to *reality*, if I may use this dubious word.

That physics has found itself selecting a reality may seem striking. For our archeological approach, however, the cross-linkage of parallel developments in several fields is even more important. We might even say the analysis could only be correct if the realization that we create reality were reached simultaneously in many aspects of modern culture.

and

Consider again quantum mechanics, where the problems of measurement theory remain unresolved after more than fifty years: How much does the experimenter control reality? What attributes of the experimenter are relevant for the exercise of this control? How different would physics be if *more* of the experimenter were allowed into the science, if more of the motivation and social connections were considered part of the experiment itself? These are some of the questions that can now be posed within the discipline of physics.

#### **Letter to Hans von Baeyer, 2 January 2006, “The Oblique Pauli”**

Look at this little gem I discovered today. I stumbled across it in the Schilpp volume on Einstein as I was researching for the talk I have to give in Utah Thursday: The topic I got roped into is whether I think Bohr gave an adequate reply to EPR. (My talk’s title is, “Why I Never Understood Bohr’s Reply to EPR, But Still Liked It.”) The quote comes from page 683:

It may appear as if all such considerations were just superfluous learned hairsplitting, which have nothing to do with physics proper. However, it depends precisely upon such considerations in which direction one believes one must look for the future conceptual basis of physics.

I close these expositions, which have grown rather lengthy, concerning the interpretation of quantum theory with the reproduction of a brief conversation which I had with an important theoretical physicist. He: “I am inclined to believe in telepathy.” I: “This has probably more to do with physics than with psychology.” He: “Yes.” —

Who else could that “important theoretical physicist” be but Pauli! They were certainly discussing these sorts of things at length at that time. Einstein wrote his remarks in 1949 (I think), while Pauli had been visiting Einstein in 1948 (recall how Pauli adjudicated the quarrel between Born and Einstein on quantum foundations during that time).

Also compare the similarity between what Einstein says above and these words of Pauli to Fierz, 10 August 1954:

All of this then led me onto further, somewhat more phantastic [*sic*] paths of thought. It might very well be that we do not treat matter, for example viewed in the sense of *life*, “properly” if we observe it as we do

in quantum mechanics, *specifically when doing so in complete ignorance of the inner state of the “observer.”*

It appears to me to be the case that the “after-effects” of observation which were ignored would *still* enter into the picture (as atomic bombs, general anxiety, “the Oppenheimer case” e.g. etc.), but in an *unwanted form*. The well-known “incompleteness” of quantum mechanics (Einstein) is certainly an existent fact somehow-somewhere, but certainly cannot be removed by reverting to classical field physics (that is only a “neurotic misunderstanding” of Einstein), it has much more to do with *integral relationships between “inside” and “outside” which the natural science of today does not contain* (but which alchemy had suspected and which can also be detected in the symbolics of my dreams, about which I believe them specifically to be characteristic for a contemporary physicist).

With these vague courses of thought I have reached the border of that which is recognizable today, and I have even approached “magic.” (From this standpoint observation in quantum mechanics might even appear to someone as a “black mass” after which the “ill-treated” matter manipulates its counter-effect against the “observer,” thereby “taking its revenge,” as a “shot being released from behind”). On this point I realize well that this amounts to the threatening danger of a regression into the most primitive superstition, that this would be much worse than Einstein’s regressive remaining tied to classical field physics and that everything is a matter of holding onto the positive results and values of the *ratio*.

So, I think it’s just got to be Pauli that Einstein is referring to!

## 18 July 2008, “‘Experience,’ with quotes and without”

**Herbal Tee 7:** *OK so how come you are not a Whiteheadian? Those throbs of experience which constitute Whiteheadian events (at least as Shimon Malin describes them) are the closest idea I have ever encountered to your famous “Zing!”—attributes of the interaction of quantum stuff with real world observers addicted to classical answers through the force of “white man’s” European post Renaissance history, power, hegemony etc etc.*

*love out of the blue, herb B*

You brightened my evening Wednesday. “Throbs of experience”—I love the phrase, and hadn’t made note of it before. It’s a deep phrase, isn’t it? The quantum measurement mysteries teach us that “experience” can’t be ignored as a component of things. But the lessons of the Copernican revolution also teach us that we shouldn’t hoard “experience” only for ourselves—“ourselves” being the agents of which the present quantum formalism takes as the localized centers of the universe.

Who knows, maybe I am a Whiteheadian. But I am so slow. Whitehead himself (as he explains at the beginning of *Process and Reality*) takes his starting point in William James and Henri Bergson. That’s where I myself am at the moment, but I also recognize that it’s only the beginning of a road.

I’m glad you came out of the blue.

## 11 May 2011, “Thinking of You”

I hope everything went well yesterday. You were in my thoughts yesterday, as your “*reality*” has been in my thoughts for years. Few understand how malleable the world is as you. Keep making it happen.

### Envoi

It was worth saying 12 years ago; it is worth saying even more so now. Herb, on the occasion of your 80<sup>th</sup> birthday, “You were in my thoughts yesterday, as your “*reality*” has been in my thoughts for years. Few understand how malleable the world is as you. Keep making it happen.”