

A TIME FOR SPACE

That which hath been is now; and that which is to be hath already
been.

King James Bible (1611)

None of our sensations, if isolated, could have brought us to the
concept of space; we are brought to it solely by studying the laws by
which those sensations succeed one another.

Henri Poincaré (1901)

Henceforth space by itself, and time by itself, are doomed to fade
away into mere shadows, and only a kind of union of the two will
preserve an independent reality.

Hermann Minkowski (1923)

Space-time becomes something like the old ether.

General Jan Smuts (1931)

In the minds of physicists space remained until the most recent time
simply the passive container of all events, playing no part in physical
happenings itself.

Albert Einstein (1933)

The nature of time is one of those baffling problems that physicists
have debated for centuries, but have made depressingly meagre
progress in unravelling.

John Barrow (2007)

Space, Einstein said, is merely what we measure with a ruler; time is
what we measure with a clock.

Louisa Gilder (2008)

It seems that most great minds have pondered space. Not as in only outer space, but simply space in which all else is found. Finding the 'all else' is key, most great minds say, to understanding space. Poincaré, who ponders more than most, says: 'It is impossible to picture empty space.'

SR builds on Poincaré. Minkowski falls in love with it. In especial with its math, its beauty. It shows, he says, that time multiplied by the speed of light is much the same as space. He likely hasn't heard the line that goes: If it looks like a duck.... But he would get it. In a spasm of enthusiasm he pronounces $t \times c$ to be a duck: He takes it to *be* space—its fourth dimension. Four months later his appendix disagrees with him and he is dead.

Many other oars are in this water. To pick two, Einstein's and Smolin's. One says we get it and one says we don't. Who's right? Well, Einstein buys Minkowski's 4-D Spacetime. His thoughts on space and time go far. But they never get to a beginning. Indeed they may stand in the way.

Smolin's take on space comes from a different direction. He sees it as something real. He needs to understand it. This is the direction I'd steer Frank surreptitiously *if* he were sitting here. He's not.

And is it space he needs to understand? Does space stand alone, aside from time? Or is it Spacetime? The distinction seems pedantic. But yesterday it's what he asks me as I lock the door. Good question, I answer, which is how to answer when there is no answer. Everything hangs on this question. Does Ecclesiastes have it right? If Spacetime rules, it's end of story. Everything's already written. Spacetime's just paging through the cosmic Kindle. That's just the way it is. Apropos Phil Collins' sad song of the Irish Troubles, finding I'm a Spacetime story wouldn't make me happy. The way it is is what space is about—if space is real.

So to me Minkowski's union is depressing. Yet Spacetime is on everybody's lips; 'Does TIME really exist?' shrieks a cover of *Scientific American*. So I need to ask myself: What does Frank need to know about it? Well, not very much. What he needs to know is how to work the space-time versus Spacetime controversy. And he should know that, when two physicists say space (or time, or Spacetime, any one of them), you can't assume that they are meaning the same thing. But most will say that, one way or another, as the universe begins, the nature of space changes, and so does that of time. The time has come to tell him he may find that, when the universe begins, space and time do not exist; many say so though it isn't a consensus.

In 1915, GR makes Spacetime dynamic. Meaning that the shape of space itself can vary over time. That's right, I'll tell him, Einstein says space has a shape and—take a deep breath—the shape of time can vary over space. Thus space and time (merged as Spacetime) become soggy and uncertain. They are no longer a fixed background for events.

GR blends space and time in the context of describing how things move. But what's that got to do with the Beginning? It's hard to imagine objects moving as the universe begins. So, I wonder, could it be that for some purposes at least, other than moving things that is, time is *not* like space?

The *Block Universe* has no room for this question. It has time and space mixed up together. It's Minkowski run amok. It's a product of eternalism, the idea that past and future have the same reality; so the future already exists. It takes Spacetime to its logical conclusion. I bet he'll think it's kooky so I make a note to tell him: Physics seems to buy this view. I don't plan to tell him but I too think it's

kooky. Reichenbach as I recall is more polite: 'The treatment of the problem of time as parallel to that of space has been detrimental.'

In the Block Universe, Spacetime is crisp. But anyone can slice and dice it just by moving. Well, actually everyone *is* moving according to most everybody else. So everyone already has a slice but they can change it anytime. Moving turns what's time to someone into space. And vice versa: It turns others' spaces into time. How? Well, by simply realizing that they are the same. Anyone who doesn't understand this is the product (it is said) of delusions or poor schooling. I should worry, not for nothin', sings Doris: Having dragged my ass through many pages of it, I can understand it but I do not buy.

Smolin has his own take on the Block:

In this way, time is represented as if it were another dimension of space. Motion is frozen, and a whole history of constant motion and change is presented to us as something static and unchanging. If I had to guess (and guessing is what I do for a living), this is the scene of the crime.

The 'crime' he's onto here is a mistaken assumption that he sees as standing in the path of progress. He thinks physics needs a better take on time. That's a story I can buy. But the Block says time is something that like space is there, laid out before us—past, present, future like left, center, right. Indeed it lacks a center. There's no now. If that's the way it is, the Ghost of Christmas Past and the Ghost of Christmas Yet to Come are one and the same character in different disguise.

I imagine a real fictional detective. He is taking notes. Time is starting to seem different to him. If he's to get a grip on how the universe began he needs to move beyond Minkowski. He's reading Reichenbach, who tells him, 'The problem of time has always baffled the human mind.'

In the 1920s the world, or at least physics, begins to come to terms with, but not grasp, relativity's Spacetime. Just at this juncture QM takes a giant step. It's back to Newton. QM needs a background, one that Newton would enjoy: space and time. Fixed, not soggy and uncertain. It's at this kind of level that QM and relativity are not mixing. Even when they're speaking of supposedly the same thing, like time, they're talking to the wall. It goes from bad to worse: QM is all time; Spacetime says it has no real existence.

GR has lots to say about space in the early universe. Quantum theory says lots less. More is needed. And of course they disagree. As he zeroes in on the Beginning, Frank may feel that he must choose between them. Once we're through with space and time I'll offer him a tip: Go look for something else.

Leaving late, the night light on, I'm in back shutting off the coffee. The door clicks open. She's speaking as she enters and her first words freeze my marrow: He says we can control it all.

She must be talking to her phone.

We're sure, she says. A pause. She opens her desk drawer.

With vehemence: The way it is!

She closes it and leaves. I breathe again.

Control it all? It seems, somehow, absurd, a contradiction. But she has my attention.