THE PROBLEM OF PERFECTION

The question, then, is how the thing gets ordered in the first place.

Richard Feynman (1965)

Only an exceptional initial condition could have led to the present order. That is the puzzle.

Julian Barbour (1999)

Perhaps every good thing that stands before us comes at a great cost to someone else.

Jamaica Kincaid (1999)

Moreover … the Big Bang theory provided no compelling reason why the universe might have been highly ordered near the very beginning.

Brian Greene (2005)

The entropy level at the beginning of the expansion of the Universe must have been staggeringly small, which implies that the initial conditions were very special indeed.

John Barrow (2007)

Is it my karma? Why would he choose this day to be here? None of this is easy for me. It's not easy to explain to *him*. But entropy, the topic of the day, must be the worst. It doesn't help that it's defined to be *dis*-order. No doubt this makes its math work well. No doubt it's good for physics. But for the hoi polloi it cuts across all easy thinking—thinking that's concerned with *order*.

Entropy seems to be one of those things that professions use to keep outsiders outside. If entropy meant order it might be a chatty topic on the cocktail circuit; but if the great unwashed were to commune with physics the profession might, like Dangerfield, soon feel it don't get no respect. One can almost hear the physicists conspiring: Order is too easy so we need some mystery. Thus when Something has more order it has *less* entropy.

Experts find entropy easy so it seems. I read reams of learned writings. Slowly it comes clear to me that what they understand is that they do *not* know exactly what it is. They understand this lack of understanding in some detail. For example, they define it differently for different disciplines. It's not clear which, if any, definition might be apropos for dealing with the universe.

One thing seems certain though: However it's defined, the early universe's entropy must be extremely low. This, physicists agree on. And *this*, I want to say

to him, for us is big! This is, I want to say, the best clue yet. It almost slips into the summary that I still do for Fearless Frank. I take it back before he gets to it. This set-up hinges on the fiction that *he's* doing the detecting here.

Low entropy means almost perfect order. This may be the way it was; it's not the way it goes. If one watches Something—anything that's isolated so disorder can't slip out the back door and go someplace else—one sees the Something get disordered over time. This is often called the *Second Law*. Frank comes up with situations he says show that this is wrong. What could be more striking than the order of a growing human brain? Well, this is where that back-door rule comes in. A human brain won't grow in isolation. If he wants to check the Second Law, he must watch the infant that comes with it, and its inputs and its outputs: the baby food and diapers; the factories that make them; the garbage dumps; the once-clean water going, dirty, down the drain; CO_2 emissions and the whole shebang. When he gets the hang of it he'll see the overall disorder grows. Kincaid has it right. Life forms make their order using energy to move disorder someplace else. Total entropy goes up.

But the entropy idea's so confusing I rebel. It can't cut it, not for me at least, and not, I'm sure, for him. I define my own term, borrowed from the German: *Ordnung*. It's like 'order' measured any of the ways that physics uses. It's the opposite of entropy. The Second Law, I tell him, says: Ordnung of an isolated system must run down. There is a wrinkle in my scheme: The opposite of entropy already has a label—information. But somehow losing Ordnung seems much simpler to explain. Losing information? Not today.

For her Frank and for my Frank, Ordnung of the universe is a big problem. Since the universe is everything there's nothing that can interfere. It's a truly isolated system. It has no back door. The Second Law says that its Ordnung must run down. So it must be more ordered as we look far back in time. Indeed, ever since the universe began—every microsecond, every million years—its Ordnung has decreased. Translated into English this means the Beginning was orderly to an almost inconceivable degree. Barrow calls it very special.

So in entropic terms the Problem of Perfection is: In its first instant the universe must be amazingly well ordered. In physics terms, its entropy is very low. How does it get to be that way? And does this question offer my guy a new clue?