regularity. "In for the penny, in for the pound," he wrote. Thus, a more accurate quote from Einstein about God and dice playing is the following:

"That the Lord should play with dice, all right; but that He should gamble according to definite rules, that is beyond me."[1]

Reference

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I enjoyed Steven Weinberg's article except for the not-so-subtle knock on religion at the beginning, where he refers to "other supposed paths to truth," and the subhead, "Science sets itself apart from other paths to truth by recognizing that even its greatest practitioners sometimes err." If the point of the article is to show the superiority of science over other "supposed paths," Weinberg confuses the issue by ending with the claim that Einstein "made no mistakes" in his decisions about "great public issues," including his opposition to militarism, his refusal to support the Stalinist Soviet Union, and his enthusiastic Zionism. Since none of those public issues are ones in which science alone can provide answers, how did Einstein achieve such infallible knowledge about them without relying on paths to truth other than science? With all due respect for his undoubted genius in science, I think Weinberg's hostility to religion is blinding him to errors in elementary logic.

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How unfortunate that Steven Weinberg chose to insert a criticism of religion—"other supposed paths to truth"—in his article. That Einstein was not infallible seems to have little relevance to the question of whether the prophets of various religions are infallible, and the latter question seems to have little place in a piece about Einstein.

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While I very much enjoyed Steven Weinberg's article "Einstein's Mistakes," I am puzzled by the author's statement about quantum mechanics: "The difficulty is not that quantum mechanics is probabilistic—that is something we apparently have to live with. The real difficulty is that it is also deterministic, or more precisely, that it combines a probabilistic interpretation with deterministic dynamics."

Quantum mechanics is an acausal deterministic theory in the sense that a physical system's state (mathematically described by a state vector) at a given initial time determines its state at a specified later time, but its state is not in one-to-one correspondence with sharp values of all its dynamical variables; that correspondence is probabilistic. Therefore events, identified by sharp values of those variables at one spacetime point, are not causally connected with other events. That is something we have to live with.

Why does the combination of these two attributes—acausality and determinism—constitute a special difficulty? Weinberg asks, "So where do the probabilistic rules of the Copenhagen interpretation come from?" Why do they have to come from anywhere other than from human brains? Nature exists out there, independent of human thought, but its mathematical description surely is a human construction rather than an immutable law given to us on a stone tablet.

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Einstein should be allowed his mistakes, like the rest of us, and Steven Weinberg understandably points out only the most newsworthy. I write to point out another misunderstanding—mistake, if you will—in Einstein's work only because it is often found in the literature today.

Einstein described diffusion as the motion of neutral particles on atomic (Brownian) length and time scales. He used a stochastic differential equation—a Langevin equation—in the high-friction limit to describe diffusive trajectories. Einstein did not discuss how his treatment could accommodate macroscopic boundary conditions or produce macroscopic flow, which is, after all, what Fick's law of diffusion is all about.

Langevin equations, in the spirit of Einstein's work, are widely used today to describe the motion and fluctuations of density of charged particles in, for example, aqueous solutions. The electric force in those equations is usually described by a steady function. Fluctuations in number density of charged particles are allowed in Einstein's treatment but fluctuations in net charge and electric potential are not. Traditional Langevin equations of Brownian motion seem inconsistent with the idea that charge creates electric force and so are unlikely to be helpful, at least in my view. It is hard to imagine systems in which the number density of ions can fluctuate while the number density of charge does not.

I believe Einstein's description of Brownian motion must be coupled to equations describing the electric field when the diffusing particles have significant charge. An equation is needed to show how the charge on one particle creates force on another. The ink particles studied by Robert Brown were surely charged. The fluctuating electric field and stochastic flow can be computed from the density of ink particles, ions, and solvent molecules by solving Poisson's or Maxwell's equations together with flow equations. (Spatially inhomogeneous boundary conditions are needed to force the macroscopic flow described by Fick's law.)

This so-called self-consistent treatment of diffusion and the electric field is used in computational electronics to design the transistors and integrated circuits of our electronic technology.[1] Diffusion and the electric field have not been treated self-consistently in most of computational chemistry and biology—for example, in simulations of molecular dynamics of ions or proteins—although such treatments are found in analyses of ionic motion through protein channels.[2–5]

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The fascinating article recounting Einstein's mistakes at different stages of his career goes beyond the usual focus on the cosmological constant and quantum mechanics. In particular, the discussion of Kaluza–Klein theory examines Einstein's later attempts at a unification theory. But in the course of developing general relativity, Einstein made another assumption, which he later tried to revisit—one that future generations may come to regard as Einstein's greatest "mistake."

Curvature of spacetime is, of course, related by general relativity to the presence of mass-energy. This curvature, though it plays out in the arena of four-dimensional spacetime, corresponds to our intuitive understanding of geometric curvature in three dimensions. General relativity also makes a crucial assumption that another geometric object, called the torsion, vanishes. That is not the only assumption that could have