

“Does Judaism Play Dice with the Universe”?

An essay/commentary by
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“I do not believe that anything occurs by accident.”

You may have heard words to this effect before and indeed the implications of this idea are more profound for us than might be apparent from a first glance. Its veracity is at the very heart of the relationship between religion and science, for example the debate between evolution and creationism. It raises many questions about who we are, why the universe and man were created, and our relationship with our world and G-d.

The title of this essay is a bit of a play on a question that the great physicist Albert Einstein agonized over during much of his lifetime, which is “does G-d play dice with the universe?” Einstein asked this question because he became increasingly uncomfortable with the direction that physics was taking at that time – a direction toward a universe whose predominant modus operandi was that of gambling with fair dice, or said in another way, a fundamentally random universe – one that operates through a process of uncontrolled and unpredictable accidents waiting to happen. Perhaps Einstein’s conundrum centered around the notion that a G-d who leaves things to chance or allows life to progress through a series of accidents cannot possibly be an omnipotent G-d because randomly occurring events are completely outside the ability to be controlled. Such a G-d does not fit the Jewish conception of *Adonai Echad* – the one G-d of all, infinite, omnipresent, omniscient and omnipotent.

For nearly three hundred years before Einstein’s birth, the philosophy of nature developed by the giants of physics, Copernicus, Galileo, Kepler and Sir Isaac Newton to name a few, was one of complete certainty and determinism. Newton’s laws of motion and gravitational attraction neatly explained the clockwork behavior of the planets in our solar system and the movement of the stars in the heavens above. There was no room for any deviations, mistakes, or accidents in these laws – they worked the same way

everywhere in the universe, and for all time. They could explain all the observed phenomena in the universe. You could even reverse the flow of time and the laws were immutable.

Even in the atomic realm the atom itself functioned as a kind of mini-solar system with the nucleus playing the role of the Sun and the electrons orbiting the nucleus according to the same rules in which the planets orbit the Sun. This science embodied a philosophy of extreme neatness – there was never a need for having to “clean up a messy room.” The universe was therefore a kind of ideal utopia where its future course was perfectly predictable. It also implied two important ideas. One is the notion of reductionism in which the laws operate the same way at all size scales, just as in the example of atoms behaving like mini-solar systems. Reductionism implies that you can take an object, any object, and chop it into smaller and smaller pieces – and that with the right kind of glue you would be able to paste all those pieces back together again to recreate the exact original object (remember Humpty-Dumpty?). Reductionism is closely related to the concept of linearity – which is the notion that “the whole is equal to the sum of its parts” and that the observed behavior of any system is proportional to the magnitude of the effects upon that system.

One can see from this that there is great room for the role of a “Prime Mover” to function as the cause of causes of such a neatly designed universe. It is in complete harmony with the theology that G-d is the first cause who set all in motion and then sat back and watched. There was no necessity for intervention once the playing field was set. G-d’s plan would unfold without deviation. He would have the role of a dispassionate observer never interfering in the affairs of, well, anything! So, in one fell swoop science was able to not only explain the entire mechanics of the universe, but could also explain the bases of western religion by specifying G-d’s job-description!

One implication of this scientific philosophy was that man’s fate was completely predetermined by nature’s laws - this implies that man lacks free will. The only thing left

for us to do was to discover the laws that were still unknown at the time – at which point we would have attained a perfect state of knowledge of our entire universe (we bite the apple?)! In other words, no longer would we have need for the omnipotent, all-powerful G-d. Mother Nature as embodied in all the physical laws of the universe would take His place. They would not even “work” side-by-side. G-d would simply become “unemployed.” Of course, the same rules that make the universe completely predictable make them completely mechanical and boring! In such a universe there is no room for miracles since by definition a miracle is a kind of “accident” in the sense of a highly unusual event. Right there then, the G-d of this mechanical world is not the G-d of our forefathers if you accept what the Torah teaches us.

Well, as in all neat and tidy stories, in the latter years of the 19th century there appeared a few nagging chinks in science’s armor. It began with Darwin and his theory, and Einstein himself ended up as the chief destroyer of that armor! At the very heart of Darwinian theory is the randomness of dice throwing. The evolution of species takes place through a series of fits and starts fundamentally governed not by the tidy rules of linearity and reductionism, but by the process of random selection. In other words, we humans evolved through a series of random “accidents” in a semi-ordered, messy, yet relentless dynamic process.

In the meantime, the physicists were having a great deal of trouble reconciling the observed increase in the disorderliness of our universe with the increasing orderliness of life itself. For example my office gets messier and messier over time, but a human embryo in the womb gets more organized throughout gestation and development. Amidst the messiness of events in the universe lies the increasing organization of life itself, like salmon swimming upstream to reach their spawning grounds. It was also observed that the very nature of light itself could no longer be rectified with the old Newtonian physics. It was discovered that light is dual-natured, sometimes behaving like a wave rolling upon the surface of the ocean, at other times like a stream of bullet-like particles. How could

anything be both waves, embodying principles of infinitely extensible and ethereal energy, and particle, embodying the finitude of corporeal matter, simultaneously?

This picture of nature was in direct conflict with the old physics of certainty and determinism. To complicate matters (no pun intended), it was subsequently discovered that electrons exhibit a wave nature which meant that the very matter that makes up all the material of the universe has this same dual-contradictory nature. This was just one of the great discoveries of Einstein embodied in his famous nonlinear equation $e = mc^2$. By demonstrating the inter-convertibility between energy and matter, and thus between particles and waves, this revolutionary equation further enlightens us to an amazing metaphysical principle: that the infinite is contained within the finite. Notice that this is not the same as the reverse, that the finite is contained within the infinite, which in itself is a trivial example of linear logic. Inevitably then, it must be so that each one of us also obeys the law, $e = mc^2$, the infinite contained within the finite, our finite physical body contained within the infinite soul.

Chance forms the basis of quantum mechanics – the branch of physics that explains how the fundamental constituents of matter and energy, atoms and light, behave. The emergence of quantum theory, which traces its origins to the 19th century, was not a quiet one in science. It was a highly troubling and revolutionary theory at the time, and those difficulties may have only worsened until now. At the heart of the matter is Heisenberg's Uncertainty Principle that posits that an observer cannot know simultaneously both the position and momentum of particles such as electrons which make up all the matter in the known universe. In other words the very nature of all material existence itself is fundamentally *indeterminate, or fuzzy*. Quantum mechanics remains today one of the most dominant paradigms in both physics and cosmology. Indeed, it is in large part responsible for the computer and information revolution characterized by the growth of the Internet! So it seemed after all, that G-d does play dice with the universe, much to Einstein's chagrin.

But perhaps there is a kind of a middle ground between the worlds of pure chance where G-d is not needed and man has complete free will, and where man has no free will because all has been predetermined by G-d from the outset. Perhaps man has free will AND G-d provides a roadmap simultaneously. Perhaps there is a world where miracles occur right before our eyes – if we open them. If both energy and matter can be simultaneously infinite and finite at the same time as we have demonstrated using the principles of nonlinear logic, then perhaps the relationship between G-d and man can be thought of in similar manner. This idea has in fact been presaged by another recent scientific revolution – that of chaos theory.

In chaos theory, the behavior of a system that is judged to be completely random based on purely objective criteria, may actually arise from a well-characterized, known deterministic system, as long as that system operates from nonlinear principles (as for example Einstein's equation $e = mc^2$ mentioned previously). This represents a paradigm shift in the history of scientific thought because previously it was fully accepted that random appearing behavior could never arise from systems that were not nonlinear! The so-called butterfly effect is an example of a chaotic system that demonstrates the characteristic of "extreme sensitivity to initial conditions". In this example it is claimed that a butterfly flapping its little wings in say Texas could be the first link in a causal chain of events leading to a full-blown hurricane occurring in the Atlantic.

A more easily accepted example of chaos is that if the Archduke Francis Ferdinand, heir apparent to the Austro-Hungarian throne had not been assassinated on June 28, 1914, World War I most likely would have not occurred, and if so, the holocaust would likely have been avoided as well. If the murder of a single man had been avoided, perhaps as many as 100 million lives might have been spared! This helps me to understand the nonlinear Kabbalistic principle that "saving one life is equal to saving the whole world." It also hints at the potential that each of us has – to destroy a world or save a world – the choices governed by our own free will.

But there is something even more interesting, indeed amazing that has been discovered recently about chaotic systems. Instead of being less amenable to external control (which one would intuit) such systems are actually easier to transform into orderly behavior using actually less rather than more energy. That is because chaotic systems are actually composed of an infinite set of orderly albeit unstable behaviors. Thus such a system can be coaxed into following one of its orderly behaviors through a process of gently nudging it to stay on course (example: keeping your drunk friend on a path while walking together). This gives G-d a new job as a covert gentle “nudger” of events.

The nonlinear logic of chaos theory has in turn given rise to the science of dynamical complexity. This science forms a foundation for understanding the basis of creativity (and therefore of creation itself), and by implication, that miracles become manifest, even inevitable. We begin to appreciate that there is a “method to the seeming madness” that we observe and experience all around us. We come to accept the notion that what we used to believe was randomly occurring events, chance meetings, and accidents, was only so because we view the world through filtered glasses. Now, we can accept the possibility that if we take off those glasses and get in touch with our true inner selves these events might fit into a well-intentioned pattern that can best be categorized by pure IS-ness (recall G-d’s answer to Moses question “what do I call you” at the burning bush).

We can even begin to understand that a consequence of such a world, where we do have free choice, is that bad things sometimes happen to good people allowing for opportunities for redemption and for returning to our Source. Perhaps by changing our point of reference in the world from “human beings having a spiritual experience” to infinite soul-beings having a human experience, we can learn to recognize, invite and indeed expect the miracles that impinge on our true-selves every day. The miracles performed by G-d, witnessed and experienced by His children as described in our sacred Torah.