Do Human Beings Have Free Will?

By: NATHAN AVIEZER

We begin our discussion of free will by making two obvious statements. First, all human beings feel that they possess free will and they have the ability to make decisions. For example, this morning, I decided to drink coffee for breakfast rather than tea; I decided to say morning prayers, while my atheist friend decided not to pray. The feeling of possessing free will is shared by everyone, including those philosophers who use their free will to staunchly deny its existence.

Second, the possession of free will is essential to understanding the Torah, which states that G-d's commandments obligate us. However, divine commandments can have meaning *only* if we are *able* to perform them, that is, if we have the *free will* to act in accordance with G-d's laws, or, if we so choose, to act contrary to these laws. This idea appears explicitly in the Torah: *I have set before you this day, life and good, and death and evil … you should choose life* (*Devarim* 30:15, 19).

In this article, we shall show that classical physics seems to indicate that free will is an illusion that does not, in fact, exist. We will then explain how quantum physics paves the way towards a resolution of this paradox. Finally, we shall discuss some recent neuroscience experiments which again claim that free will is only an illusion.

Physics

To appreciate the challenge that physics presented to the existence of free will, one must first understand some elements of the history of the scientific enterprise.

In 1687 Isaac Newton published the *Principia*, undoubtedly the most important book of physics ever written. In this work, Newton presented his new discoveries and proclaimed that all physical phenomena can be explained in terms of a few laws of nature—by no means a generally accepted idea at that time. Newton's greatest successes lay in his formulation of the laws of mechanics—his famous three laws of motion—and his discovery of the law of universal gravitation.

Nathan Aviezer is Professor of Physics and former Chairman of the Physics Department of Bar-Ilan University. He is the author of more than 140 scientific articles on solid state physics, was elected as a Fellow of the American Physical Society and is a Research Professor of the Royal Society of London.

The sun, moon, and planets have been the object of continuous stargazing for thousands of years. Nevertheless, explaining the motion of these heavenly bodies had long eluded the best efforts of astronomers. It was not until Newton's discoveries that it finally became possible to explain planetary motion. However, to calculate how the heavenly bodies move across the sky, it was not sufficient to discover *the laws of nature*. New mathematical techniques were required *solve the equations* implied by these laws of nature. This challenge, too, was successfully met by Newton, who developed the mathematics of the calculus, which enabled him to solve the equations that describe the motion of the heavenly bodies.

Because the sun is so very massive (containing 99.86% of the mass of the entire solar system), the primary contribution to the gravitational force acting on each planet is due to the sun. Newton proved that if one ignores the much smaller gravitational forces due to the other planets, then each planet will move around the sun in an elliptical orbit, as had previously been deduced by Kepler in the early 1600s on the basis of astronomical observations. In subsequent years, however, the newly invented telescope permitted much more precise measurements of planetary motion, and these newer data revealed clear deviations from simple elliptical orbits around the sun. The question then arose: Could Newton's theory of gravity also account for these more accurate measurements?

The great practical difficulty in predicting the details of planetary motion stems from the fact that not only the sun, but *every* planet, exerts a gravitational force on every other planet. Although the gravitational forces due to the other planets are relatively small, because the mass of the planets is so much smaller than that of the sun, these forces are not negligible and must be included. This leads to a very complicated set of equations for planetary motion, which are extremely difficult to solve.

The French mathematician Pierre-Simon de Laplace, born a century after Newton, greatly extended Newton's astronomical calculations, and succeeded in explaining all the details of the observed planetary motion. Before the work of Laplace, it was not even known whether the solar system was stable. Even the great Newton had expressed doubts, thinking that the outer planets would eventually drift away from the sun. It was left to Laplace to provide the definitive proof for the stability of the solar system.

The Clockwork Universe

Laplace's lifework is contained in his multi-volume masterpiece *Celestial Mechanics*, summarized in 1796 in his classic *The Exposition of the System of*