

Butterflies, Providence, and the Story of Esther

In the summer of 1666, the English physicist and mathematician Sir Isaac Newton is said to have pondered the falling of an apple while in the gardens of Woolsthorpe Manor, his family home in Lincolnshire. This apocryphal story describes the seminal moment which prompted him to realise that there must be a force acting on the apple which draws it to the centre of the earth.

After publishing his universal law of gravitation together with his three laws of motion in 1687, Newton was able to not only explain the fall of an apple, but also the orbits of the moon and other celestial bodies with incredible accuracy. This discovery heralded a revolution in scientific understanding which resonated with the beginning of the enlightenment period. The cosmos was no longer mysterious; epitomised by William Blake's painting of Newton as the divine geometer, God could be replaced with the rational scientist as master over a measurable, knowable and predictable clockwork universe.

This strengthened the concept of causal determinism which implies that every physical event has a physical cause or group of causes. In any system, given one set of specific initial conditions, only one physical outcome is possible.

Yet almost 300 years later in 1961, the American mathematician and meteorologist Edward Lorenz was running a computer algorithm designed to model weather systems. Each variable such as temperature, wind speed and atmospheric pressure, had to be entered manually. After running the model and generating a normal but sophisticated weather system, Lorenz decided to repeat the experiment but rounded one variable of 0.506127 to 0.506.

As the algorithm started to run, it began to produce the same results. Yet in a short time it had deviated from the original model and ultimately generated a completely different weather system.

When Lorenz went to present the work, his colleague Philip Merilees devised the title "Does the flap of a butterfly's wing in Texas produce a tornado in Brazil?" Lorenz's most famous observation soon became known as the 'butterfly effect'.

The flap (or non-flap) of the butterfly represents a tiny change in the initial conditions comparable to Lorenz rounding up the initial variable to 0.506. Although compatible with a deterministic universe, unlike Newton's celestial orbits, complex systems such as the weather are not predictable for long periods due to the immeasurable number of influencing variables and the unforgiving sensitivity to initial conditions.

By implication, the butterfly effect must be true for every complex system; traffic flow, a football match or even the countless interactions we have each day. At every moment of our lives, the decisions we make and interactions we have will affect the future; the chance meeting with an old friend, missing the train or a social introduction by a mutual acquaintance. In fact,

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every decision that we make, consciously or subconsciously affects a myriad of interconnecting factors that make up our lives.

Each year on the festival of Purim, we read the story of Esther which describes how the Jewish people were saved from schemes of the wicked Haman. Yet while we recount the miracles which God performed at that time in our prayers, there is no reference in the story to any miracle. In fact, God is not mentioned once.

Yet miracles in which God can influence our lives do not have to break the laws of nature. In our prayers we thank God *al nisecha sheb'chol yom imanu* – for the miracles that are with us each day.

Rabbi Moshe Chaim Luzzatto (d. 1746) explained that God uses natural phenomena to influence His creation, triggering the hidden miracles which guide our lives. Rabbi Yisroel ben Eliezer (d. 1760) described God's interaction with the physical world extending to even the most mundane natural phenomena, such as a wisp of straw blown from a thatched roof or the path of a falling leaf. While we cannot see God's guiding hand directly, the butterfly effect resonates with the notion that God can intercede in the running of the world without being noticed.

In simple language, Megilat Esther means the scroll of Esther, but the root of the word Megillah is גלה from the verb לְגַלוֹת - *l'galot*, meaning to reveal and Esther is from the root סתר, from the verb לְהַסְתִּיר - *l'hastir*, meaning to hide something. Megilat Esther therefore means 'revealing that which is hidden': God's guiding hand.

This is why we dress up on Purim, symbolically hiding our true identity. As we drink wine, the real self is slowly revealed – in vino veritas, or as the sages of the Gemara put it, *nichnas yayin, yetzei sod* – as the wine goes in, the secret comes out.

Our celebrations on Purim therefore convey the deepest expressions of our faith in Divine Providence and the hidden, yet ever-present hand of God. The challenge for us is whether we choose to bolster our faith and recognise the Divine influence in our lives or submit to the cold randomness of a Godless world.

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