Astronomy without a telescope: The unlikeliness of being

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The search for extraterrestrial intelligence could be a waste of time according to a recent statistical analysis of the likelihood of life arising spontaneously on habitable-zone exoplanets out there in the wider universe (and when have predictive statistics ever got it wrong?). Credit: SETI Institute.

History has proved time and again that mathematical modelling is no substitute for a telescope (or other data collection device). Nonetheless, some theoreticians have recently put forward a statistical analysis which

suggests that life is probably very rare in the universe – despite the apparent prevalence of habitable-zone exoplanets, being found by the Kepler mission and other exoplanet search techniques.

You would be right to be skeptical, given the Bayesian analysis undertaken is based on our singular experience of abiogenesis – being the origin of life from non-life, here on Earth. Indeed, the seemingly rapid abiogenesis that occurred on Earth soon after its formation is suggested to be the clinching proof that abiogenesis on habitable-zone exoplanets must be rare. Hmm…

Bayes theorem provides a basis for estimating the likelihood that a prior assumption or hypothesis (e.g. that abiogenesis is common on habitable-zone exoplanets) is correct, using whatever evidence is available. Its usage is nicely demonstrated in solving the Monty Hall problem.

Go here for the detail, but in a nutshell:

There are three doors, one with a car behind it and the other two have goats. You announce which door you will pick – knowing that it carries a 1/3 probability of hiding the car. Then Monty Hall, who knows where the car is, opens another door to reveal a goat. So, now you know that door always had a zero probability of hiding the car. So, the likelihood of the remaining door hiding the car carries the remaining 2/3 probability of the system, since there was always an absolute 1/1 probability that the car was behind one of the three doors. So, it makes more sense for you to open that remaining door, instead of the first one you picked.

In this story, Monty Hall opening the door with a goat represents new data. It doesn't allow you to definitively determine where the car is, but it does allow you to recalculate the likelihood of your prior hypothesis (that the car is behind the first door you picked) being correct.

Applying Bayesian analysis to the problem of abiogenesis on habitable-zone exoplanets is a bit of a stretch. Speigel and Turner argue that the evidence we have available to us – that life began quite soon after the Earth became habitable – contributes nothing to estimating the likelihood that life arises routinely on habitable-zone exoplanets.

We need to acknowledge the anthropic nature of the observation we are making. We are here after 3.5 billion years of evolution – which has given us the capacity to gather together the evidence that life began here 3.5 billion years ago, shortly after the Earth became habitable. But that is only because this is how things unfolded here on Earth. In the absence of more data, the apparent rapidity of abiogenesis here on Earth could just be a fluke.

This is a fair point, but a largely philosophical one. It informs the subsequent six pages of Spiegel and Turner's Bayesian analysis, but it is not a conclusion of that analysis.

The authors seek to remind us that interviewing one person and finding that she or he likes baked beans does not allow us to conclude that most people like baked beans. Yes agree, but that's just statistics – it's not really Bayesian statistics.

If we are ever able to closely study an exoplanet that has been in a habitable state for 3.5 billion years and discover that either it has life, or that it does not – that will be equivalent to Monty Hall opening another door.

But for now, we might just be a fluke… or we might not be. We need more data.

Source: Universe Today