Education and Heritage in the era of Big Data in Astronomy
Proceedings IAU Symposium No. 367, 2020
R. M. Ros, B. Garcia, S. R. Gullberg, J. Moldon & P. Rojo, eds.
doi:10.1017/S1743921321000284

Solar eclipses: A pump of curiosity for early humans?

Graham Jones

The University of Shiga Prefecture,
Hikone, JP 522-8533, Japan
email: graham@tensentences.com

Abstract. The dramatic nature and irregular frequency of solar eclipses may have helped trigger the development of human curiosity. If the kind of solar eclipses we experience on Earth are rare within the Universe, human-like curiosity may also be rare.

Keywords. eclipses, astrobiology, extraterrestrial intelligence, Earth, Moon

1. Introduction: Where is everybody?

According to the Copernican principle, there is nothing special about the Earth's place in the Universe. However, on the current evidence, human curiosity — defined here as our desire for reasons and explanations — is unique. No matter where we point our telescopes, we find no signature of extraterrestrial intelligence. This contradiction is an example of the Fermi paradox, also known as the Great Silence (Brin 1983), and described as "one of the most pressing problems in science" (Webb 2015).

A potential astrobiological solution is the Rare Earth hypothesis, which states that the development of complex life depended upon a combination of factors that may be vanishingly rare within the Universe. In short, humans may not be "so ordinary as Western science has made us out to be for two millennia" (Ward & Brownlee 2000).

2. A new question: Extending the Rare Earth hypothesis

Biological complexity does not automatically lead to curiosity. For instance, chimpanzees show no interest in magic tricks (Matsuzawa 2020). Nevertheless, human development arrived at a point where "we find it appropriate to describe the reasons why some things are arranged as they now are" (Dennett 2017). We can therefore ask: does the Earth have a special ingredient that led to the development of not only complex life, but also curious life?

The Earth's environment is notable for its regularity; even phenomena such as earthquakes are "part of life" in the areas where they tend to occur (Hinga 2015). Yet "too much regularity in the selective environment can be a trap" (Dennett 2017). Even though the wiring of the human brain evolved in an exceptional way (Ardesch *et al.* 2019), if novelty had remained below a certain threshold, early humans may not have received a sufficient trigger to begin forming the concept of reasons.

3. Solar eclipses: Off-the-scale novelty, by chance

The "dramatic nature" (Pasachoff 2017) of solar eclipses produces lasting effects on humans (ibid) and human culture (Blatchford 2016). Solar eclipses would have provided early humans with novelty on a scale unlike anything else within the environment. Francis

Baily, a pioneer of solar physics in the 19th century, noted that "I can readily imagine that uncivilised nations may occasionally have become alarmed and terrified at such an object" (Baily 1846).

Although solar eclipses are not rare in the Universe (Lazzoni 2020), the kind of eclipses that humans experience — end-of-the-world simulations that come, literally, out of a clear blue sky — may be exceedingly rare. Crucially, the nature and frequency of solar eclipses on Earth are the result of two chance circumstances: the Moon and the Sun have the same angular diameter, and the Moon's orbit is inclined to the ecliptic.

4. Conclusion: The pump of curiosity?

Solar eclipses, which "take place at very irregular intervals for a given place" (Meeus 1982), may have pumped novelty into the environment at an ideal rate to trigger the development of curiosity in early humans. If solar eclipses occurred more routinely, they may not have provided a sufficient dosage of novelty; if they occurred less frequently, they may not have delivered a sufficient number of injections of novelty, over time, into human communities.

Given that the nature and timing of solar eclipses is the result of chance, this pump of curiosity may be part of the solution to the Fermi paradox: even if complex life is common in the Universe, curious life may be rare.

Acknowledgements

I am grateful to the following for their comments and support: Ian Blatchford (Science Museum, London), John G. Cramer (University of Washington), Daniel C. Dennett (Tufts University), Cecilia Lazzoni (University of Padova), Tetsuro Matsuzawa (Kyoto University), Amelia Ortiz-Gil (University of Valencia), Jay M. Pasachoff (Williams College), Steffen Thorsen (timeanddate.com) and Stephen Webb (University of Portsmouth).

References

Ardesch, D.J., Scholtens, L.H., Li, L., Preuss, T.M., Rilling, J.K., & van den Heuvel, M.P. 2019, *PNAS*, 116(14), 7101

Baily, F. 1846, *MemRAS*, 15, 1

Blatchford, I. 2016, *Phil. Trans. R. Soc. A*, 374, 20150211

Brin, G.D. 1983, *QJRAS*, 24, 283

Dennett, D.C. 2017, *From bacteria to Bach and back: The evolution of minds* (WW Norton & Company)

Hinga, B.D.R. 2015, *Ring of fire: An encyclopedia of the Pacific Rim's earthquakes, tsunamis, and volcanoes* (ABC-CLIO)

Lazzoni, C. 2020, Personal communication, 20 August

Matsuzawa, T. 2020, Personal communication, 3 September

Meeus, J. 1982, *J. Brit. Astron. Assoc.*, 92, 124

Pasachoff, J.M. 2017, *Nat. Astron.*, 1(8), 1

Ward, P.D., & Brownlee, D. 2000, *Rare Earth: Why complex life is uncommon in the Universe* (Copernicus Books)

Webb, S. 2015, *If the Universe is teeming with aliens … where is everybody?: Seventy-five solutions to the Fermi paradox and the problem of extraterrestrial life*, 2nd ed. (Springer)