Published online 21 December 2007 | Nature | doi:10.1038/news.2007.384

Column: Muse

We're all going to die

Can humanity be saved from catastrophe, and is the cost worth it?

Daniel Cressey

> "Physics seems to support Kafka's remark that 'there is infinite hope, but not for us'."

As a scientific journalist, one of my jobs seems to be telling you what you're going to die of this week. At the moment, climate change is pretty popular, cancer once took the top slot, next week another 'planet killer' asteroid could be discovered ready to smash into our fragile blue planet.

I normally only have to consider these threats one at a time. But Jason Matheny, a PhD student at Johns Hopkins University in Baltimore, Maryland, has looked at the bigger picture in his latest paper, "Reducing the Risk of Human Extinction"[1]. In one fell swoop he addresses how to assess the risk of every major cataclysmic event coming our way: a fantastic topic, I think, to balance against all the festive joy of this holiday season.

"While extinction events may be very improbable," he notes sagely, "their consequences are so grave that it could be cost effective to prevent them."

Some efforts are already underway to combat such threats. The nonprofit organization The Lifeboat Foundation, for example, was set up with the express aim of preventing human extinction. Currently, it says, it is "pursuing a variety of options", including "self-sustaining space colonies in case the other defensive strategies fail".

They probably wouldn't get on well with the Voluntary Human Extinction Movement, which has the motto "May we live long and die out".

Thankfully, there is some more serious work on assessing and tackling the risk of total annihilation of our species. In 2005, for example, Nick Bostrom, director of the Future of Humanity Institute at the University of Oxford, UK, co-authored a Nature paper entitled Is a doomsday catastrophe likely? This details the calculation of the probability of a terminal catastrophe not caused by humans[2]. "We have shown that life on our planet is highly unlikely to be annihilated by an exogenous catastrophe during the next 10^9 years," says an extended version of this piece[3].

By contrast, in 1960 a paper in Science opened with the following text: "Doomsday: Friday, 13 November, A.D. 2026. At this date human population will approach infinity if it grows as it has grown in the last two millenia."[4] That's a bit less encouraging.

Against this backdrop, Matheny asks, is it cost effective to try to combat the various threats to mankind?

Time to go

The first stage in answering this question, Matheny reckons, is to determine how long we might have left. In the short-term, as we have seen, we have to avoid overpopulation, nuclear war, asteroid impacts, gamma-ray bursts, climate change, "a genetically engineered microbe ... causing a global plague" and rogue high-energy physics experiments. But even assuming we survive all that, in the long-term we have to deal with the fact that our Sun is going to enter red giant stage in about a billion years' time.

If we make it off Earth and colonise elsewhere we could get to 100 trillion years, he determines — until the other stars start to burn out too. If we can use "nonstellar energy sources" we could even make it to what Matheny reckons is our upper limit: 10^{41} years hence. "Physics seems to support Kafka's remark that 'there is infinite hope, but not for us'," sighs Matheny.

Once you've got an ultimate time limit and an estimated future population (both a bit tricky) you can work out how many 'life-years' you are attempting to save by averting various disasters, provided you have the probability of the disaster in question (even trickier). Then you need to know how expensive threat reduction would be. Finally, you need a cost-effectiveness threshold — a level below which you're going to be willing to spend the money.

The probability of a disaster is, of course, a bit hard to work out if it has never happened before. Matheny quotes from a variety of thinkers on this in his paper. These range from John von Neumann, who in the first half of the twentieth century apparently thought it was "absolutely certain that there would be a nuclear war; and that everyone would die in it" to the 50-50 odds, stated in 2003 by Britain's astronomer royal Sir Martin Rees, of humanity reaching the 22nd century.

Giant killer space rocks

For an example of cost effectiveness, the paper looks at reducing the extinction risk posed by asteroids. On the basis of data and estimates from NASA and others, Matheny assumes that a 'detect and deflect' system would set us back $20 billion.

And how many lives is this likely to save? First, we assume a population of 10 billion surviving as long as our closest relative Homo erectus did, about 1.8 million years (much more conservative than the optimistic 10^{41} years), leaving us with 1.6 million years to go. We set the chance of us being hit by a killer asteroid at about one in a million. Then we assume our defence system reduces our risk by, say, 50%.

On the basis of this shedload of assumptions, for cost per life-years saved we get: Cost / (Population x Survival time x Risk x Risk reduction). In terms of Matheny's estimates, this works out as: $20 billion / (1.6 x 10^{16} x 1/1million x 0.5) = $2.50 per life-year.

As a comparison, the UK health service works on a threshold of about £25,000 ($50,000) per life-year for medical treatments it funds[5]. Let's get started on that system, people.

Of course, it is likely that many will take issue with the numbers in Matheny's paper, the error bars on which are, well, huge. It is hard, however, to imagine many taking issue with his take-home message:

"We take extraordinary measures to protect some endangered species from extinction. It might be reasonable to take extraordinary measures to protect humanity from the same." And that — the protection of humanity — is a most suitable thought for the holiday season.

References

1. Matheny, J. Risk Analysis 27, 1335-1344 (2007). | PubMed |
2. Devlin, N. & Parkin, D. Health Economics 13, 437-452 (2004). | Article | PubMed |
3. Tegmark, M. & Bostrom, N. Nature 438, 754 (2005). | Article | PubMed | ChemPort |
4. Tegmark, M. & Bostrom, N. http://arxiv.org/PS_cache/astro-ph/pdf/0512/0512204v2.pdf
5. Von Foerster, H. *et al.* Science 132, 1291-1295 (1960). | Article | PubMed | ChemPort |

Commenting is now closed.