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Are We Living in a Computer Simulation?

High-profile physicists and philosophers gathered to debate whether we are real or virtual—and what it means either way.

[Scientific American](#)

- Clara Moskowitz



Photo by Yagi Studio / Getty Images.

If you, me and every person and thing in the cosmos were actually characters in some giant computer game, we would not necessarily know it. The idea that the universe is a simulation sounds more like the plot of “The Matrix,” but it is also a legitimate scientific hypothesis. In 2016, researchers pondered the controversial notion at the annual Isaac Asimov Memorial Debate here at the American Museum of Natural History.

Moderator Neil deGrasse Tyson, director of the museum’s Hayden Planetarium, put the odds at 50-50 that our entire existence is a program on someone else’s hard drive. “I think the likelihood may be very high,” he said. He noted the gap between human and chimpanzee intelligence, despite the fact that we share more than 98 percent of our DNA. Somewhere out there could be a being whose intelligence is that much greater than our own. “We would be drooling, blithering idiots in their presence,” he said. “If that’s the case, it is easy for me to imagine that everything in our lives is just a creation of some other entity for their entertainment.”

Virtual Minds

A popular argument for the simulation hypothesis came from University of Oxford philosopher Nick Bostrom in 2003, when he suggested that members of an advanced civilization with enormous computing power might decide to run simulations of their ancestors. They would probably have the ability to run many, many such simulations, to the point where the vast majority of minds would actually be artificial ones within such simulations, rather than the original ancestral minds. So simple statistics suggest it is much more likely that we are among the simulated minds.

And there are other reasons to think we might be virtual. For instance, the more we learn about the universe, the more it appears to be based on mathematical laws. Perhaps that is not a given, but a function of the nature of the universe we are living in. “If I were a character in a computer game, I would also discover eventually that the rules seemed completely rigid and mathematical,” said Max Tegmark, a cosmologist at the Massachusetts Institute of Technology (MIT). “That just reflects the computer code in which it was written.”

Furthermore, ideas from information theory keep showing up in physics. “In my research I found this very strange thing,” said James Gates, a theoretical physicist at the University of Maryland. “I was driven to error-correcting codes—they’re what make browsers work. So why were they in the equations I was studying about quarks and electrons and supersymmetry? This brought me to the stark realization that I could no longer say people like Max are crazy.”

Room for Skepticism

Yet not everyone on the panel agreed with this reasoning. “If you’re finding IT solutions to your problems, maybe it’s just the fad of the moment,” Tyson pointed out. “Kind of like if you’re a hammer, every problem looks like a nail.”

And the statistical argument that most minds in the future will turn out to be artificial rather than biological is also not a given, said Lisa Randall, a theoretical physicist at Harvard University. “It’s just not based on well-defined probabilities. The argument says you’d have lots of things that want to simulate us. I actually have a problem with that. We mostly are interested in ourselves. I don’t know why this higher species would want to simulate us.” Randall admitted she did not quite understand why other scientists were even entertaining the notion that the universe is a simulation. “I actually am very interested in why so many people think it’s an interesting question.” She rated the chances that this idea turns out to be true “effectively zero.”

Such existential-sounding hypotheses often tend to be essentially untestable, but some researchers think they could find experimental evidence that we are living in a computer game. One idea is that the programmers might cut corners to make the simulation easier to run. “If there is an underlying simulation of the universe that has the problem of finite computational resources, just as we do, then the laws of physics have to be put on a finite set of points in a finite volume,” said Zohreh Davoudi, a physicist at MIT. “Then we go back and see what kind of signatures we find that tell us we started from non-continuous spacetime.” That evidence might come, for example, in the form of an unusual distribution of energies among the cosmic rays hitting Earth that suggests spacetime is not continuous, but made of discrete points. “That’s the kind of evidence that would convince me as a physicist,” Gates said. Yet proving the opposite—that the universe is real—might be harder. “You’re not going to get proof that we’re not in a simulation, because any evidence that we get could be simulated,” said David Chalmers, a professor of philosophy at New York University.

Life, the Universe and Everything

If it turns out we really are living in a version of “The Matrix,” though—so what? “Maybe we’re in a simulation, maybe we’re not, but if we are, hey, it’s not so bad,” Chalmers said.

“My advice is to go out and do really interesting things,” Tegmark said, “so the simulators don’t shut you down.”

But some were more contemplative, saying the possibility raises some weighty spiritual questions. “If the simulation hypothesis is valid then we open the door to eternal life and resurrection and things that formally have been discussed in the realm of religion,” Gates suggested. “The reason is quite simple: If we’re programs in the computer, then as long as I have a computer that’s not damaged, I can always re-run the program.”

And if someone somewhere created our simulation, would that make this entity God? “We in this universe can create simulated worlds and there’s nothing remotely spooky about that,” Chalmers said. “Our creator isn’t especially spooky, it’s just some teenage hacker in the next universe up.” Turn the tables, and we are essentially gods over our own computer creations. “We don’t think of ourselves as deities when we program Mario, even though we have power over how high Mario jumps,” Tyson said. “There’s no reason to think they’re all-powerful just because they control everything we do.” And a simulated universe introduces another disturbing possibility. “What happens,” Tyson said, “if there’s a bug that crashes the entire program?”

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