Reflection essay 1: what is physics?

Gary Zhang

Internet clickbait quizzes suck. Despite years of crystal ball promises, they have failed to guess my favorite color, my sandwich preferences, my age, whether I'm left-handed or right-handed, or whether I'm part of the 8% of people who are from the east coast but act like I'm from the west coast.

What kind of scientist would you be? Answer 3 simple questions to find out!

However, although clickbait quizzes fare miserably at analyzing us and telling us about ourselves, we can tell a lot about ourselves by how we analyze *them*. As the saying goes, "we don't see things as they are; we see them as *we* are." So, I'll bite. What kind of scientist am I?

You are stranded on an island, and you only get one thing to entertain yourself until you are rescued. Which do you choose?

- Slip 'n slide
- Jetski
- Spinny chair

Classical mechanics is about as old as physics itself, because it's here that physics has its roots. Why do we move faster when the slip 'n slide is wet? Do we double our downhill distance when we double the time, or do we go four times more? One of the earliest theories of motion, that *all things come to a rest*, lies with Aristotle, a philosopher whose boundless theories were only overshadowed by his boundless ego. Yet it was humbler men, like the gutsy Galileo Galilei and reclusive Isaac Newton, who could be called physicists proper. Putting tradition to the test, they realized real-world objects refused Aristotle's rules, and infused physics with new rigor by devising their own laws. Their work goes straight to the essence of physics: physics is a discipline based on evidence. In empirical physics, evidence is observation and experiment; in theoretical physics, it is mathematics consistent with past knowledge.

A jetski is subject to physics too. It never sinks on the water despite the pull of gravity, thanks to fluid mechanics. A jetski's motor transforms chemical fuels into rotational kinetic energy, a process studied in thermodynamics. Motor vehicles often include a battery, possible due to electromagnetism. Wave mechanics guide how it bobs up and down. Physics studies the way the world works.

Sometimes, physics can even be out of this world. Nothing beats the thrill of coasting in a spinny chair, as if the entire universe decided to pick up its feet and dance around you. And maybe, that's exactly what happens. If there were no island, no Earth, and no stars to guide the eye, how would we know it isn't the universe spinning, and we sitting at rest? This question is too a physics question, and scientists disagree on the answer.[1] These fields, astrophysics and relativity, are also physics, built with the same rigor as the rest of physics.

Which fictional character would you most like to meet in real life?

- Scooby Doo
- Sisyphus
- Mary Poppins

Among the goals of physics include discovery. Humanity evolved under the shroud of ignorance; we had no clues about our world beyond *monkey see, monkey do* behaviors inherited from our ancestors. However, curiosity guided our sleuthing, and we put facts together to unmask the nature of reality. The universe, no matter how feeble we are in comparison to its majesty, cannot hide its mysteries from us. "I would've gotten away with it, too, if it weren't for those meddling physicists." And of course, just as Scooby Snacks fuel detectives, physicists grind their coffee to grind out discoveries.

This goal of discovery never ends. Solving one problem opens two more, and every new hypothesis brings a new round of what-if's. The Sisyphus of legend, a Greek king found guilty of cheating death, was condemned by the gods to forever push a boulder uphill.[2] Whenever exhausted Sisyphus neared his goal, down the ball rolled, forcing him to start anew. Physicists take pride in being above myths and superstition, and mostly, this is true. When it comes to archaic myths, they're all Greek to me. But physicists, at least in academia, endure a lifetime seeking grants and coffee, all for the elusive five-sigma—the

[1] Rothman, T. Am Sci, **105**, 344. (2017). `https://doi.org/10.1511/2017.105.6.344`

[2] Cartwright, M. *Sisyphus*. (2016). `https://www.worldhistory.org/sisyphus`.

same Greek letter that begins, and ends, Sisyphus's name. Perhaps we're not so different after all.

However, this process isn't so dismal, and in fact, should give us hope. Like most sciences with applied subfields, a final goal of physics is to help people. Physics has built flying machines, granted us instantaneous long-distance communication, and lit up our world—electrically. Equally electrifying is to think how many challenges physics has yet to solve, and how many lives of the next generation will be touched. Physics is hard, and failures are bitter, but the chance to impact lives is irresistibly sweet. After all, a spoonful of sugar makes the coffee go down.

If you could be a legendary creature, what would you be?

Rumor has it that wherever people live, there lives a mysterious species, hidden in plain sight yet never directly seen. Called *ideal physicists*, they are both ideal at physics, and the ideal person. They are bold creative thinkers, but also use their knowledge to serve people before profit. Most of them own a t-shirt about the scientific method, and on picnics, their tablecloths are actually conference posters. When an ideal physicist met Chuck Norris, even Chuck Norris put down his fists and sought their knowledge. Although some argue these physicists are largely legends, like leprechauns and magnetic monopoles, others believe they can be approximated, like the spherical cow or absolute zero. Though real physicists often fall far from the ideal, striving to be a better physicist is to strive to be better thinkers and people.

Congratulations! Based on your quiz results, we think you'd be... a physicist.