Another way to prevent cheating

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I read with great interest Toni Feder's report on efforts by the teaching community to prevent cheating (Physics Today, August 2022, page 25). I would like to point out what I believe is an opportunity for learning institutions to act against predatory sites that host stolen test materials.

A safe harbor provision in the Online Copyright Infringement Liability Limitation Act (OCILLA) protects such sites if they don't know that they are hosting copyrighted material. According to the law, the sites can lose that protection if the copyright owner notifies them of the infringement. That requires a serious effort from the affected party to find the materials at the sites and notify the hosts. In my case, I have stopped doing that for a simple reason: Even if the materials are removed, they are usually back up in a matter of days as other students repost them.

But OCILLA also indicates that the sites may be liable if there are red flags that they ignored. Students often upload their problems in the form of screenshots or pictures, which advanced sites make searchable by scanning the text. That means that the next time a similar picture is uploaded, the sites have the technology to detect material that the instructor has already flagged as copyrighted. By accepting the material a second time, they may be violating the red-flag criterion.

I hope that colleges and universities explore that legal route as a way to reduce the unbearable levels of cheating that has put online education in serious trouble.

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Laudable lectures

In William Thomas's commentary "Elitism in physics: What happens when the profession's cultural scaffolding comes down?" (Physics Today, September 2022, page 10), the author notes that Richard Feynman's famous introductory undergraduate course "proved by his own admission to be of dubious pedagogical value." Indeed, in his preface to the *Feynman Lectures on Physics*, Feynman noted that he didn't think he "did very well by the students." But as someone who attended Caltech in the 1960s, I'd like to note that I—and it seemed many of my classmates—did not hold that same opinion.

In the 1960s and 1970s, the *Feynman Lectures* formed the basis of Caltech's two-year sequence in introductory physics. I entered the university as a freshman in the fall of 1966. During the first quarter of the year, the freshman physics lectures (based on the *Feynman Lectures*) were delivered by Robbie Vogt, a young and charismatic member of the faculty and eventual provost of Caltech. As Vogt concluded his final lecture of the term, we freshmen—all 210 of us—rose as one for a standing ovation. The thunderous applause continued for well over five minutes, with Vogt repeatedly disappearing into a room behind the blackboards only to reappear for "curtain calls."

The succeeding five quarters were taught by five other faculty members: Edward Stone, a prominent cosmic-ray physicist; Barry Barish, a corecipient of the 2017 Nobel Prize in Physics; Robert Leighton, a coauthor of the *Feynman Lectures* and author of *Principles of Modern Physics*; Jerry Pine, a high-energy experimentalist turned biophysicist and science educator; and John Bahcall, a theorist who established the feasibility of the Bahcall–Davis solar-neutrino experiment. All were treated to warm rounds of applause at the conclusion of their respective quarters of instruction. I consider Feynman's physics lectures one of the high points of my undergraduate days at Caltech.

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Mavericks who failed

I enjoyed Tomasz Durakiewicz's commentary in the November 2022 issue of Physics Today (page 10) about the benefits of being a maverick. He gave some wonderful examples of mavericks who succeeded, but what about those who failed? Some failed for bad reasons, such as trying to create perpetual motion machines. But some—such as Albert Michelson and Edward Morley in their famous experiment—failed for good reasons, and the world learned something from their failure.

I spent the bulk of my career doing research in industry. A director of research at one lab used to say, "If we're succeeding all the time, we're not trying hard enough." The question then becomes how does one reward the "good" failures. I don't think he ever figured that out. Has physics?

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Hubble has more time

In the article "Electric propulsion of spacecraft" by Igor Levchenko, Dan Goebel, and Katia Bazaka (Physics Today, September 2022, page 38), the authors mistakenly refer to the *Hubble Space Telescope*'s "hydrazine thrusters."

As project scientist for *Hubble* from 1972 to 1983—the period of its creation as a real piece of hardware, its design, and its early phases of construction—I clearly recall that thrusters of any sort were not incorporated. That was because UV performance could potentially be lost through contamination by any gas used in thrusters.

Levchenko, Goebel, and Bazaka mention that "the telescope could potentially spiral back to Earth by 2028." Without a dedicated mission of another spacecraft to raise the orbital altitude of *Hubble*, the telescope will eventually decay into the upper atmosphere of Earth. That will cause *Hubble* to lose control of its pointing before finally making a fiery return. That is well in the future, with project leaders now estimating that there is a 10% chance that reentry will occur by October 2034, a 50% chance by July 2037, and a 90% chance by October 2045.

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Superdeterministic loophole

In her excellent Physics Today report "Physics Nobel honors foundational quantum entanglement experiments" (December 2022, page 14), Heather Hill discusses how the laureates closed loopholes in the interpretation of entanglement. She rightly concludes that the freedom-of-choice loophole remains open, but she describes it incorrectly, writing, "Taken to an extreme, the loophole can suggest that every event in all spacetime was determined by the initial conditions at the Big Bang, an idea called superdeterminism."

Actually, that idea—that later events can be determined by earlier ones, and vice versa—is simply called determinism. There is a centuries-old philosophical tradition called compatibilism, which holds that even in a deterministic world we are free agents if we can do as we like without constraint. In the context of the Bell experiment, a compatibilist would say that experimenters are free to choose how to set their polarizers (for example, using the birthday of their grandparents or light from distant quasars), determinism notwithstanding.

Superdeterminism is much more subtle than that (and as a result is typically misunderstood or grossly oversimplified in the media). It is based around the following question: Do the laws of physics allow us to vary the Big Bang initial conditions in such a way that we could describe a hypothetical universe where the same pair of entangled particles—that is, with the same hidden variables—are measured with differently set polarizers? Such a universe is counterfactual, and superdeterminism describes an emergent restriction on such counterfactual measurements imposed by suitably formulated putative laws of quantum physics.[1,2]

No experiment to date has closed the superdeterministic "loophole." Indeed, we are still searching for a realistic experimental protocol that can test it. We will get there one day, hopefully in the not too distant future, but it will likely not be via a Bell experiment.

References

1. T. N. Palmer, *Proc. R. Soc. A* **476**, 20190350 (2020).
2. S. Hossenfelder, T. Palmer, *Front. Phys.* (2020), doi:10.3389/fphy.2020.00139.

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