

## Correction

### SCIENCE AND CULTURE

Correction for “Science and Culture: The value of a good science hack,” by Stephen Ornes, which appeared in issue 29, July 19, 2016, of *Proc Natl Acad Sci USA* (113:7928–7929; 10.1073/pnas.1607652113).

The editors note that on page 7928, left column, second full paragraph, line 11, “electron–positron collisions” incorrectly appeared as “proton collisions.” The article has been updated online.

[www.pnas.org/cgi/doi/10.1073/pnas.1612334113](http://www.pnas.org/cgi/doi/10.1073/pnas.1612334113)

# Science and Culture: The value of a good science hack

Stephen Ornes, *Science Writer*

Physicist Matt Bellis attended his first Science Hack Day in the fall of 2010, in Palo Alto, California. Like many scientists attending the event for the first time, Bellis was skeptical. “Hacking,” after all, is usually left to computer programmers.

However, Bellis, at the time a postdoctoral researcher at the SLAC National Accelerator Laboratory, had an idea that wasn’t exactly typical for SLAC: He had a trove of experimental particle physics data that he wanted to somehow turn into sound, and he thought that music and computer specialists, among others, could help. A friend urged him to attend Science Hack Day. Once there, he spent a Saturday morning describing his proposal, and, by the afternoon, an interdisciplinary team of programmers, scientists, artists, and others joined him in a 24-hour quest to make electron–positron collisions sing.

## Derived from Discontent

Bellis’s story is typical among first-time attendees. Science Hack Day was borne of dissatisfaction with how science is usually conducted and how information is shared—or not. In the spring of 2010, Ariel Waldman—futurist, graphic designer, science popularizer—led a panel at the South by Southwest festival in Austin, TX, about public access to scientific information. “We started talking about how frustrated we were that there was a lot of open science data out there, and nobody was doing anything interesting with it,” she recalls.

Jeremy Keith, a British web page designer in the audience, suggested they launch hack days as a way to capitalize on all that data.

So they did: Keith organized the first one, in London, that summer. Waldman organized the second one in the fall, at the Institute for the Future—a design studio and research organization in Palo Alto (the one that Bellis first attended). They invited scientists, designers, artists, programmers, and curious others to gather for 24 hours and create something with science, no matter how silly, serious, or strange.

Bellis says he had no idea what to expect, but was delighted by the project that emerged from that weekend. His Science Hack Day team’s approach was to translate energy into volume—so, instead of the conservation of energy, the program had to obey the conservation of volume. That meant a high-energy particle decaying into two particles of less energy would sound like a single loud note being replaced by two separate, quieter tones. “Sometime around midnight,” he recalls, “we started to get sounds related to the properties of these particles.” Bellis was astonished for two reasons. First, he’d been pretty pessimistic about their progress, and second, he knew he’d never have come up with this approach on his own. He vowed to return.

Waldman, now the global director for Science Hack Day, saw the enthusiasm of participants like Bellis and wanted to make sure the event would continue. “It was very clear from the get-go that this would be a thing,” she says. At the same time, she wanted to avoid creating an institution or an authoritative administrative presence, so she published a set of instructions for planning an event, free to anyone on the event’s website. The instructions include tips on finding sponsors, organizing a budget, and setting up a schedule. Her intent was to empower anyone to set up their own Science Hack Day. Last April’s gathering in Tenerife, Spain, was the 50th Science Hack Day; 19 countries have hosted events. “The reality is that there are geeks everywhere, and people in Silicon Valley make silly weird things just as much as people in Kenya or Madagascar or China,” she says. “That’s been a real delight.”

## Portrait of a Hack

Although no two Science Hack Days are alike, they have the same blueprint. They’re free and open to everyone until registration is full. Scientists, coders, science enthusiasts, artists, web programmers, and dozens—if not hundreds—of others arrive on a Saturday



Matt Bellis (green shirt) takes part in the 2014 Science Hack Day in San Francisco. Image courtesy of Flickr/Matt Biddulph.

morning, pitch ideas to each other, and eat lunch. Teams form, and the hacking begins, typically in office or design space that allows people and ideas to flow easily from one place to another. (The “orphans” whose ideas don’t attract a team may join other projects or go it alone.) Work continues until Sunday afternoon presentations, when teams show the fruits of their frenzied rush to make something. Curiosity and collaboration make strange but captivating bedfellows, says Waldman.

Also, she says, scientists often undergo a sort of transformation. They come in as skeptics, and leave convinced that such unorthodox collaborations can lead to something interesting. Creations range from the innovative—such as a tree-of-life heat map, showing the relative research density of different organisms—to the sweetly ridiculous, such as a candy color sorter for people averse to certain hues of Skittles or M&Ms.

Some projects skew toward the potentially practical. Biologist Jessica Polka, a postdoctoral researcher at Harvard Medical School who works with bacterial polymers, attended the 2013 Boston event to help develop a tool that translates biological jargon into everyday English. She and other biologists had been discussing her field’s jargon-laden language and “how bizarre that must sound to outsiders,” she says. To bridge that gap, her team produced an online translator—still live today—fueled by a Google document in which users can add new terms and translations to the word list. “The great part about doing it at Science Hack Day was having access to nonscientists who could help with the interpretation of words that we, as biologists, take for granted.” Polka, like Bellis, attended the first Science Hack Day in 2010 and has helped organize events in Boston.

In some cases, Science Hack Day projects may take on a life beyond the weekend—and even have a career impact. Now on faculty at Siena College in New York and a member of the Compact Muon Solenoid collaboration at the Large Hadron Collider, Bellis returned to Science Hack Day in 2011 in San Francisco. While he was there, he was impressed by a team that built a “beard detector.” It seemed nonsensical, but the idea was simple: A hacked USB microscope could take images of a user’s face and, with only about 20 lines of code, use pattern recognition to differentiate stubble from skin.

Bellis saw something strangely familiar when he looked at the images of the small hairs jutting in different directions on the screen. The identified hairs “looked like particle tracks in cloud chambers,” he recalls. That gave him an idea: Could he use the same code to record the movement of cosmic rays through a cloud chamber? These devices track ionizing particles such as decaying radioactive particles or high-energy cosmic rays.



**Bellis developed this cloud chamber largely as a result of his Science Hack Day activities. He eventually installed two of them at the Cornell University physics department. Image courtesy of Flickr/Matt Biddulph.**

He took the idea to a Science Hack Day in the fall of 2013 and left with a working, low-cost cloud chamber prototype that shows the trails of cosmic rays passing through. Since then, he’s been refining the device; he and his students attended a 2014 Science Hack Day where they taught others to build them. Earlier this year, he installed two of his home-made cloud chambers in the physics department at Cornell University.

Of course, things don’t always go according to plan. “Occasionally, some scientists come in with a very concrete, big idea of what they want to do, and halfway through will realize it’s not feasible,” says Waldman. “They have to deal with scrapping their

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**—Matt Bellis**

idea and coming up with something new in the late hours of Saturday. This can be stressful, but . . . it ends up sparking even more creativity.”

Many projects don’t coalesce until the wee hours in the middle of the night. Others fail. But Bellis sees this as an inherent risk in an event driven by pure curiosity. “As experimentalists, we cannot be afraid to fail,” he says, noting that the event has given him freedom to be creative without the pressure to produce.

“For this one weekend, I’m just going to play out of my sandbox to muck around with science and art,” Bellis says. “Every now and then, something brilliant and amazing comes out of it. Many times it won’t, but that’s science.”