Playing With Life: Are Living Video Games Ethical?

BY MARNI USHEROFF / Jul 14, 2013

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This piece is part of Mashable Spotlight, which presents in-depth looks at the people, concepts and issues shaping our digital world.

A dozen students huddle around a laptop-strewn table crammed with palm-sized circuit boards and unruly rainbows of wire. Each student tinkers with his or her own clear plastic platform, which resembles an Ikea twin bed no bigger than a box of Kleenex. A webcam attaches to the headboard, staring down at a square pool pressed into the bed, illuminated by a single LED wired to the footboard.

The class's instructor, Geva Patz, unscrews a small jar, sucks out an eyedropper full of liquid and carefully squeezes a few beads into the tiny pool, as students gather around. Patz rotates the webcam's focus ring back and forth until the student's laptop screen sharpens with a flurry of what looks like white rice grains, swimming erratically.

"We have paramecia!" Patz announces with a giddy flourish.

The class is a joystick away from achieving its goal: creating do-it-yourself, living video games.

The students will also need to add a digital layer of graphics over the action on their screens, allowing the tiny creatures to swim around virtual obstacles or appear to interact with them.

"There's something fascinating about controlling organic life with electricity," marvels Tesia Kosmalski, 37, a class participant. An old Cool Whip container full of crocodile clip wires, LEDs and lead pencil pieces sit on the chair beside her.

Hosted at Genspace, a community biolab in Brooklyn, N.Y., the Arduino Wet Pong workshop spanned the course of three evenings in March and April. Its name refers to tiny computing platforms called Arduinos, the notion of wet lab work combined with biological matter, and one of the earliest arcade video games, *Pong*.

The course is a collaboration between Patz, a software and hardware developer, and Genspace president, cofounder and biologist Dr. Ellen Jorgensen. It shows how the growing biohacker movement fosters small niches that, in this case, enable the general public to craft "biotic video games," systems that incorporate living microorganisms.

While these games are a far cry from *Halo* or *World of Warcraft*, they've garnered international interest from both scientists and the general public over the past five years. Creators believe this concept has the potential to engage both kids and adults in learning about biological processes.

But a small number of observers think that interfering with living things for entertainment, even on such a microscopic scale, raises ethical issues. At the heart of this argument is a concern for human beings' level of control over life. If we alter organisms or manipulate them for fun, are we entering into an unhealthy relationship with the world around us?

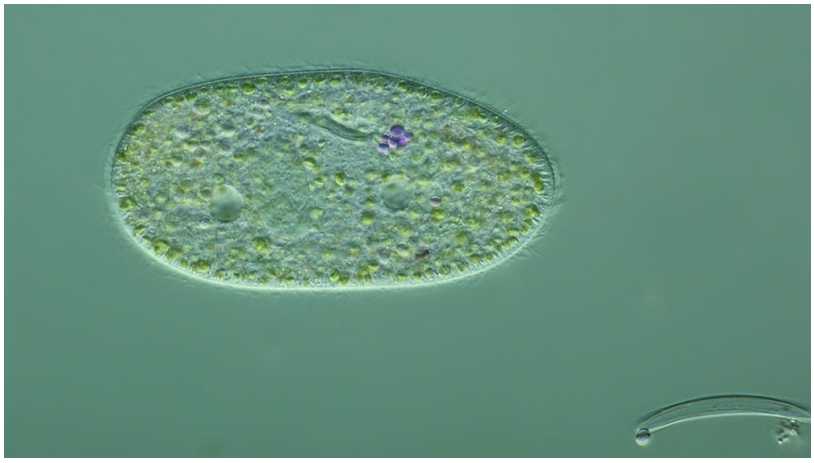

Image courtesy of Wikimedia Commons, Frank Fox

When Jorgensen first watched a YouTube video of the biotic games that Stanford bioengineering professor Dr. Ingmar H. Riedel-Kruse created a couple of years ago, she was hooked. The footage had been released alongside one of the professor's papers in early 2011.

During a phone call from his office at Stanford, Riedel-Kruse explains that about four years ago he developed a vague idea of what biotic video games could be like. He'd been thinking about the similarities between modern biotechnology's synthetic circuits and the simple electronics of 50 or 60 years ago.

"You have video games, so why aren't we making games on a more biological platform, as well?" Riedel-Kruse wonders.

He says he coined the term "biotic video games," along with his results: a

soccer-themed game called *Ciliaball*. He digitally laid the image of a virtual soccer field and ball atop a magnified, paramecia-filled pool. To earn points, players must guide their paramecia to "kick" the ball into the virtual goals. Users influence the organisms by pushing buttons on a handheld controller, which administers a light charge to one end of the tiny pool. The critters then swim in the opposite direction, in a phenomena called "galvanotaxis."

Riedel-Kruse believes these games and others he's created, and the way Genspace presents them to the public, will get people engaged and inspired to learn about biology, optics, microfluidics — all the technologies involved in the system. It's a form of education through play.

"Kids are really excited if you put a microscope in front of them and they kind of observe these critters," he says. "Kids also play lots of video games, which is very interactive and attractive. If you merge the two, you could imagine what this kind of effect potentiates."

Riedel-Kruse asks undergraduate students to build their own biotic games in class, and he continues to develop the concept for educational use in schools and museums.

The more he works with the games, the more their unique challenges become clear. Riedel-Kruse has grappled with their robustness, for example. Unlike the electronics in regular video games, microorganisms can't just be left alone. When you want to play with them again a day or so later, they might not behave as well — they might even be dead. Riedel-Kruse has been working on making the games more user-friendly.

Although he's applied for a patent on a specific version of the games, he hopes these things take off, whether via hobbyists or commercial development.

"I really believe that this could help inform science education," he says.

Nearly halfway around the world, biotic game developer Dr. Marc Dusseiller has literally made an art out of this approach to informal science education. The nanobiotechnologist spends much of his time teaching a mixture of biohacking and art to hackers, geeks and artists in Europe and Asia, through Hackteria, the biological art collective he cofounded.

Before he started instructing the public how to turn webcams into microscopes or to make their own bacteria printers, Dusseiller was integrating what he called "hybrid-games" into a micro and nanotechnology course he taught to life science undergrads at the University of Applied Sciences in Northwestern Switzerland in 2008.

"I had to come up with a practical-based lab course, and I didn't want to do some fake experiments," Dusseiller says over Skype, from his home in the Swiss countryside. He also wasn't doing any research in which he could involve his students. "We could try to create games by connecting nano and microtechnologies to living systems like microorganisms. I thought, okay, I want to connect the practical part to a daily life experience, and have fun."

Image courtesy of Flickr, Ethan Hartman

Dusseiller and his students devised a modular system they could use over the long term to develop hybrid video games. They wanted to build a miniature arena in which they could control environmental conditions and host microorganisms, then try to combine the technology and living systems into a game concept.

He insisted that all software be open-source, so that subsequent classes could add to the platform. Dusseiller also wanted his students to make their own instruments, which fostered the creation of his DIY microscope: a webcam modified by removing the lens, flipping it over and reinstalling it, effectively transforming it into a magnifier.

The students struggled with technical problems during the first year, which Dusseiller says was the whole point. "I don't want to give them something that works. I want them to develop it and make errors themselves."

The following year, the video games took shape. They included *Biosnake*, a riff on the old-school arcade game wherein players direct a digital snake to eat pieces of food. The snake grows longer, increasing the risk it'll eat its own tail.

Image courtesy of National Parks Service

Biosnake used live webcam video to capture a slow-moving water bear, an eight-legged microorganism that resembles a chunky version of the caterpillar from Disney's animated *Alice in Wonderland*. He paired it with a digital virtual game layer of *Snake*, integrating the water bears as obstacles.

"Especially in the field of nanotechnology, you wouldn't expect to do this kind of trashy do-it-yourself setup for practical teaching," Dusseiller says between drags of a cigarette. "But that's my style ... I think the idea of the game was very fruitful for inspiring the students — instead of just giving them simple measuring

tasks in a lab course, which is usually done using expensive equipment, to find out something that's already known."

In the end, Dusseiller and his students named the whole educational concept "*wetPONG*."

Not everyone sees value in playing games with living organisms. Some people are downright outraged.

In 2009, protesters boycotted Hackteria's "experimentation on organisms," as one local paper put it, at the Norwegian open-source art festival *Piksel*.

But protesters never actually consulted with the Hackteria members about the work they presented, says Dusseiller. "I was a bit disappointed that these people did not come and talk to us, because we have completely the opposite ethical debate going on during these workshops."

In fact, Dusseiller tries to focus on ethics in his Hackteria classes by including a special session called "The Furry Boundary."

"Obviously people react very differently if something has fur," he says. "We want to tell people that there is lots of life on a microscopic scale, and it's also worthwhile to be protected."

He mentioned that after a couple of days in his classes, students tend to fall in love with their water bears. "This is why they're very useful, because they're cute," he says through a wide grin. "People don't want to kill them. While, if you work with nematodes, small worms, people are a bit disgusted — this is not the message we want to have."

Riedel-Kruse also received a bit of criticism when several online articles publicized his 2011 paper, or showcased the games in YouTube videos.

In one video posted by Stanford (above), Riedel-Kruse demonstrates how the games work. A YouTube comment by user "kunukn" reads, "Seems wrong somehow, using living things for own gaming fun purpose. Next is to play chess by moving animals around a field and get them to kill each other when you take a piece."

And a *New Scientist* article entitled "Play Pacman, Pinball and Pong with a Paramecium" generated a comment from Romanian veterinarian Dr. Liviu Gaita: "Deeply unethical and worrying ... incredible that a Stanford academic can see such games as 'educational tools.'"

In an email interview, Gaita, who supports People for the Ethical Treatment of Animals (PETA), explains that he thinks these games run counter to moral good sense. "They are a perfect illustration of how a hideous act can be wrapped as a benign, even educational act," he writes. He suggests that "even unicellular beings have obvious individual interests" and worried these games would "nourish the idea that humans are not part of, nor do they relate responsibly to the biological universe, but they master that universe."

When asked about these concerns, Riedel-Kruse points to the high ethical

standards university lab experiments must maintain. But he understands others might have their own feelings about such matters. He estimates about 10% of people who've seen his work in person are curious about potential ethical concerns.

To Riedel-Kruse, it's important to educate the public about the underlying facts. He referenced the microorganisms present in our everyday lives; we kill tens of thousands of bacteria when performing simple tasks such as cleaning our kitchen sinks or toilets.

He thinks these games might be good catalysts for a bioethical discussion, "to try to separate what are the more rational arguments and what is your own personal emotion."

Photo by DeAgostini/Getty Images

Bioethicist Gregory Kaebnick of The Hastings Center finds the games mentioned in Riedel-Kruse's paper to be completely unobjectionable. Even so, he can see the ethical long view and potential problem areas.

"There's this growing question about the level of control that we humans have over the domain of life," he says. Our ability to alter living things or use them for benefit raises a larger set of concerns. But he doesn't believe these questions about the human relationship to life can be resolved with an all-or-nothing approach. Although some people might not be happy about it, we draw distinctions between different kinds of living things, and permit treatment of some that we wouldn't consider acceptable for others.

The human relationship to nature can itself be an important moral consideration. "What's at stake in environmental sentiment — protection of endangered species and wilderness issues — is that we shouldn't be completely reworking the entire natural world just for the fun of it or human benefit," Kaebnick says. "We ought to have some sense of gratitude or reverence."

He adds, "There's no algorithm for coming up with that. If we think about life as this single, great big monolithic category with a capital 'L,' it makes it much more difficult to figure out what the balance is. If you seem to be saying any kind of human intervention [is wrong], you're raising the bar really high for what counts as human intervention into nature."

In contrast to these heavy ethical discussions, the overriding sentiment during Genspace's class is lighter and simpler — it's exciting. The students, most of whom appear to be adults stopping by after work, enjoy the opportunity to work with their hands and glimpse microscopic life with the aid of technology they'd constructed themselves.

Toward the end of the night, Alexis Rondeau, 34, cranes over his classmates'

shoulders to watch the paramecia zoom chaotically across another student's screen. "It's like the L train in the morning!" he exclaims.

As the instructor, Patz is clearly fascinated when biology and electronic worlds collide. A lifelong tinkerer, his technical repertoire has included sophisticated algorithms for high-speed options trading, an award-winning large-scale amateur fireworks display and an inflatable giant fuchsia squid with waving tentacles.

The "itch remained unscratched" until he discovered Genspace and enrolled in its synthetic bio course in December, which touted the "science of engineering living organisms as if they were biological machines." Not only was the material exactly what Patz had wanted, but the community lab setting was a natural fit for a devout DIY enthusiast who once rigged his kitchen toaster with a temperature sensor and Arduino interface.

When the folks at Genspace discovered Patz was so adept with Arduinos, they asked him to do a one-off workshop for a few of the lab's students and teachers. Jorgensen explained that, unlike a lot of other DIY bio groups, they don't have a lot of electronics people. Patz happily obliged, and his class has since been a huge success.

Still, Jorgensen is surprised there were any ethical objections to these games. "I just can't get emotional about the rights of unicellular organisms," she says. "They don't even have a nervous system or a brain."

During the final session of Genspace's Wet Pong course, students wire a tiny black knob to their Arduino microcontroller. One woman squeezes a few drops of paramecia into her stand's tiny divot, and her laptop screen fills with a chaotic cluster of white grains. She grasps her joystick and gently pushes it in a circular motion. As if on cue, the mob of paramecia seems possessed by an unseen power and starts swimming around the pool in a synchronized circle. Two classmates peek over her shoulder in awe as she carefully guides the critters back and forth.

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