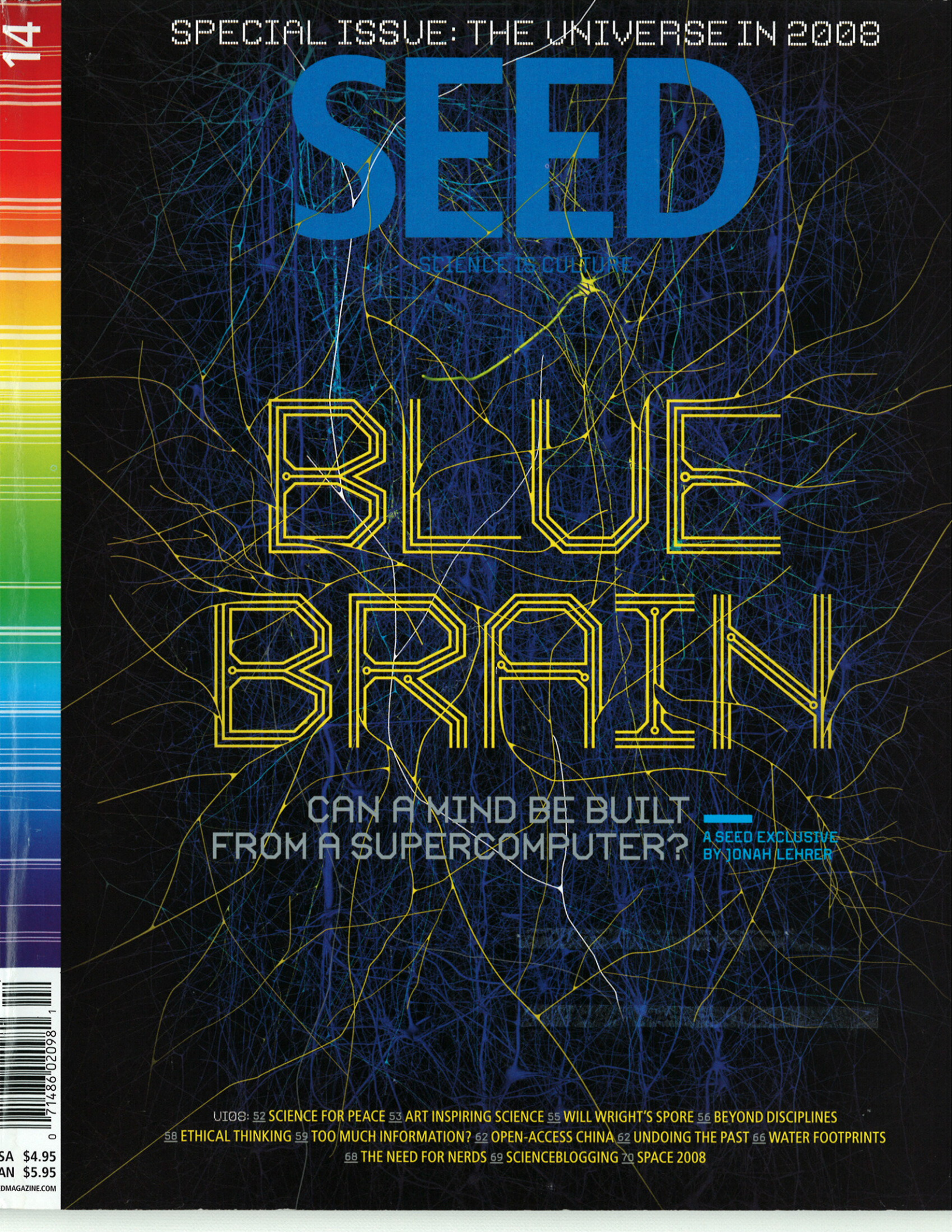
SPECIAL ISSUE: THE UNIVERSE IN 2008

SEED

SCIENCE IS CULTURE



BLUE BRAIN

CAN A MIND BE BUILT FROM A SUPERCOMPUTER?

A SEED EXCLUSIVE BY JONAH LEHRER

14

0 71486 02098 1

SA $4.95
AN $5.95

DMAGAZINE.COM

GAMING SCIENCE From the beginning, video games have been inspired by science: 1962's *Spacewar!*, created by MIT computer scientists, featured a physics model that included gravity and a scrolling background based on real star charts. Since then, the relationship has only deepened. Beyond gaming's obvious reliance on science for its enabling technology, game designers have capitalized on disciplines like physics and biology to create sophisticated graphics and realistic worlds. Now video games are returning the favor, as tools of science collaboration and empowerment. ¶ Virtual worlds like *Second Life* and *World of Warcraft* are becoming proving grounds for the theories of economists, ethnographers, and epidemiologists, and swarms of linked video game consoles now offer essentially any researcher access to one of the world's largest distributed computing networks. Cleverly designed games are starting to use their players to perform real science, creating a new audience of pupils and volunteers who collectively compete in tasks like sorting stardust, classifying galaxies, and improving search algorithms. In 2008, gaming could transform the way science is communicated and performed—but only if scientists successfully turn their work into play.

THE NEW GAME PLAN

Game designer Jane McGonigal introduces her new project for The Institute for the Future, and champions the potential of "massively multiplayer science."

ALBERT EINSTEIN, AN AVID chess player, once said: "Games are the most elevated form of investigation." As far as we know, Einstein preferred to keep his gaming hobby and his scientific research separate. But in 2008 and beyond, the elevated forms of investigation that games enable could result in important research breakthroughs. Game designers and scientists are increasingly blending their activities, paving the way for a new form of investigation where a game's arbitrary puzzles and fictional problems are replaced by real scientific questions that groups of players can cooperatively solve.

I call this trend massively multiplayer science (MMS). The concept is simple: Build scientific practices into a collaborative gaming framework, and you can unleash hordes of players to gather observations, find patterns in data, and contribute new hypotheses. It may not seem like science as we know it, but considering the core features of the scientific method, the idea is sound. Scientists often solve problems by forming networks, working together in teams to test different strategies and compare results. The process is highly social, extremely challenging, and purposely iterative—you perform the same experiment again and again, just like in a game. And at the end of the day, when all the results are in, you know who the winner is.

While more multiplayer science projects are being designed and deployed to tackle research goals than ever, they're not working as well as they could. The stumbling block is getting enough people to play along. The efforts so far have limited their appeal by focusing on specialized research areas instead of broad, interdisciplinary questions. Many have initially achieved astronomical numbers of participants, only to later "crash" when people lose interest and stop playing en masse. What's needed is a way to appeal to a wider audience, and to keep them engaged.

In spring of 2008, my colleagues and I at the Institute for the Future are launching an MMS game that places scientists within an immersive, collaborative environment designed to keep them all engaged over many weeks, months, and possibly years. Dramatic fictional scenarios, multi-player missions, and performance feedbacks like scoring and progressively harder challenges will direct players' scientific forecasting activities and push them to continue seeking creative, collective solutions to open-ended problems. In essence, we're working to make thinking about new ways to do science as accessible and entertaining as pop culture.

Scientists often solve problems by forming networks. The process is highly social, extremely challenging, and purposely iterative—you perform the same experiment again and again, just like in a game.

Developed in collaboration with the National Academy of Sciences, the game is part of the Institute's new *X2 Project*, which takes its main inspiration from actual scientific history. In Victorian London, several young, brilliant scientists had created a social group called the "X Club" to influence scientific inno-

Q&A

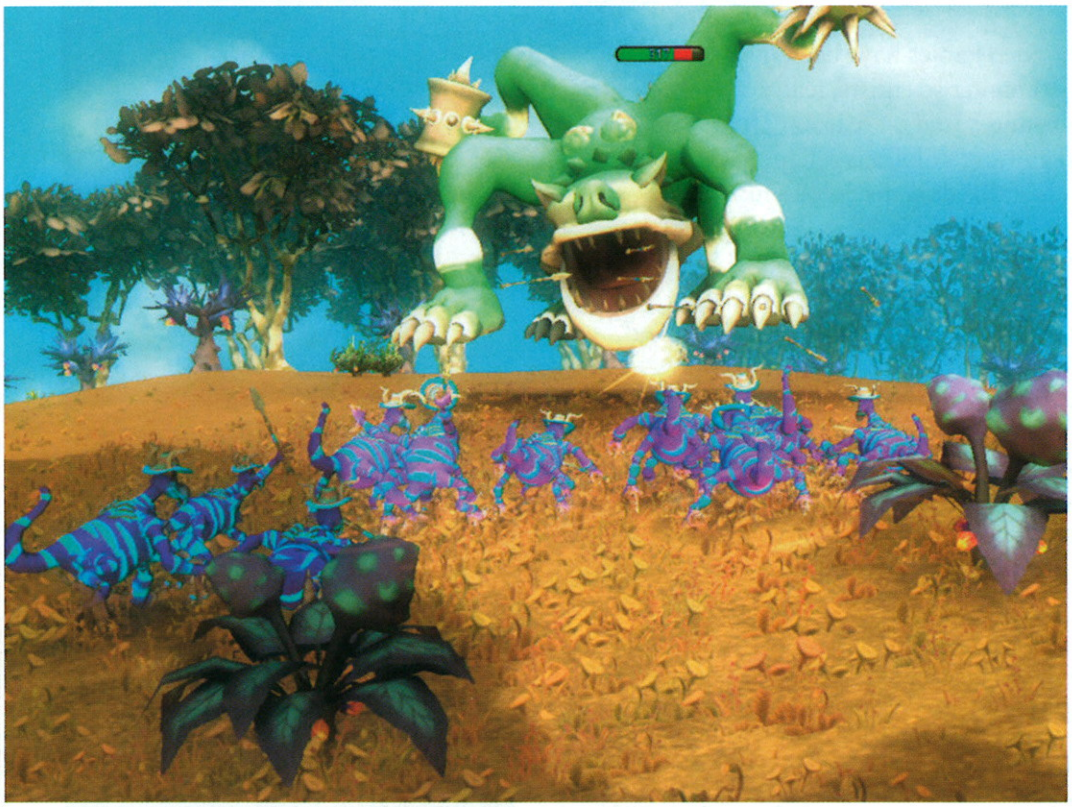
SIT. STAY. GET SMARTER.

Leading artificial intelligence (AI) researcher Ben Goertzel wants to harness the users of online virtual worlds to help develop AI with "common sense." In 2008, his company, Novamente, is partnering with The Electric Sheep Company to introduce trainable virtual animals into *Second Life*.

WHY USE VIRTUAL WORLDS TO DEVELOP AI?
To create a realistic AI, it needs a body and a world to interact with. But robotics is extremely expensive. In a virtual world, it's easy to put a million AI agents in front of a million users who can teach and nurture the AI as if it were a child. Collectively, users could "grow" an AI that could understand itself, solve problems, and communicate using language.

SO HOW WILL AN AI ANIMAL WORK?
Each animal has a learning algorithm that enables it to spontaneously try new ways to achieve its goals—like pleasing people and being fed—and allows users to explicitly teach the animal new tricks. It remembers what's happened to it and how it has accomplished goals.

WHAT'S THE NEXT STEP?
We'd like to release creatures that understand language and then teach them to speak. If enough users get involved, you could see greater intelligence in the population of virtual agents over time. The more they learned, the more their ability to learn would increase. That acceleration would be a huge leap forward for AI research.



vation; within a decade, they were all lions of the British scientific establishment. Our MMS is built upon the story of a new, modern X Club, where the players are its members, tasked with expressing their opinions on the future of science and forming new collaborations to solve problems. Though at first open only to scientists, *X2* will eventually allow the public and policymakers to engage and play. By aggregating their speculations, we hope to create a massively multiplayer simulation that will not only help define tomorrow's science, but also influence the professional practice and public understanding of science today.

Alex Pang, a principal investigator on the *X2 Project*, describes the game as a chance to rethink fundamental assumptions about how to achieve scientific breakthroughs. "A scientific revolution is a period where the rules of the game break down and you create new ones." Projects like *X2* are a new kind of scientific game where we all can collectively redesign the rules—where the networks are open, the teams are bigger, and the winning outcomes may be vastly more surprising. —*Jane McGonigal*

A TRIBE OF EVOLVED VIRTUAL creatures hunts its prey in Will Wright's *Spore*.

THE SPORE SYLLABUS
Spore, a video game from Electronic Arts slated for release in mid-2008, gives players the tools to "evolve" a single microbe floating in a planet's primordial soup all the way to a galactic civilization. As interdisciplinary as its chief inspiration, astrobiology, *Spore* incorporates themes from several scientific disciplines. Here, *Spore*'s creator and lead designer, Will Wright, lists the top ten influences on the game's design.

› SETI scientists **FRANK DRAKE** and **JILL TARTER** › **POWERS OF TEN** by Charles and Ray Eames and Philip Morrison › **THE BLIND WATCHMAKER** by Richard Dawkins › **BIOPHILIA** and **CONSILIENCE** by E.O. Wilson › **2001: A SPACE ODYSSEY** by Stanley Kubrick and Arthur C. Clarke › **GENERATIVE MUSIC 1** by Brian Eno › **MONSTERS, INC.** by Pixar Animation Studios › **THE UPLIFT TRILOGY** by David Brin › **THE LIFE OF THE COSMOS** by Lee Smolin › **AFTER MAN: A ZOOLOGY OF THE FUTURE** by Dougal Dixon

"Complexity is the new science. Everything is complex; every problem in the world is a system. The disciplines are classified by people, but nature never recognizes them."

C.S. KIANG
founding dean of the College of Environmental Sciences, Beijing University

LACK OF DISCIPLINES

New ideas and new institutions are pulling down the barriers between the sciences to tackle the world's most complex problems.

GATHERED AT A PRE-AWARDS press conference in Stockholm last year, the 2007 Nobel laureates were unanimous: We've arrived at a time when traditional boundaries within the sciences—be they theoretical or experimental—don't mean so much anymore. And while it's become commonplace to see a program bill itself as inter-, cross-, or multi-disciplinary, we're now seeing the emergence of an entirely new breed of schools and research institutes that might best be described as "post-disciplinary." Some, like Para Limes in the Netherlands and the Princeton Center for Theoretical Physics, are small and intimate thought-incubators that will seed ideas across several minds for future novel collaborations. Others, like the Arizona State University Biodesign Institute and the Wisconsin Institutes for Discovery, involve multi-million-dollar construction projects, state-of-the-art laboratories, and hundreds of new faculty.

What most have in common, however, is a focus on solving specific problems—letting the issues drive the research instead of the other way around. From creating a breast cancer vaccine to determining the origins of life on Earth to finding solutions to global warming, the new paradigm bridges old boundaries to tackle our most intractable questions. In 2008, we're entering an era that no longer needs to make explicit the merger of the physical, the social, and the life sciences because it never sees them as separate in the first place. ∞

IMAGE COURTESY OF ELECTRONIC ARTS. OPPOSITE GRAPHIC BY DICK KLAVANS, KEVIN BOYACK/SCITECH STRATEGIES, INC.