



# FUTURAMA

What will the world be like 10 or 20 years from now? How will we live, work, and play? Will we even exist? Our collective curiosity compelled us to cobble together a visionary roster of both experienced experts and self-confessed soothsayers who all weighed in on where we'll be at in the fields of religion, entertainment, fashion, literature, and many, many more. A brave new world awaits all of our children and grandchildren, and this, for good or ill, is what it will look like

ILLUSTRATED BY DAN MATUTINA



**DEFYING GRAVITY**  
Clockwise: Virgin Galactic astronauts enjoying weightlessness in the spacious SpaceShipTwo cabin; Virgin Galactic's WhiteKnightOne and SpaceShipOne; conceptual design of the \$200 million Spaceport America in New Mexico; a test flight of Virgin Galactic's VMS Eve mothership over Mojave, California.



▶ TRAVEL

## CLOSE ENCOUNTER

The thought of exploring the final frontier may not be so far-fetched, after all. **William E. Halat**—George Washington University professor and founder of virtual think tank TechCast (techcast.org)—explains why space tourism could be a billion-dollar industry by 2020

**T**he idea seemed silly at first, but now that a few private individuals have traveled into space, it seems likely that more will follow soon.

Interest in space tourism is already strong, and costs should fall dramatically as space privatization proceeds. A variety of private ventures are underway to carry passengers into space, put them up at space hotels, travel to the Moon, and conduct other activities.

“We’re on the verge of the golden age in space,” thinks Peter Diamandis, who funded the X Prize. “It should soon be possible for the public to tour space on a routine basis.”

TechCast estimates that passengers could fly around the Earth sometime about 2014.

The feasibility of private space flights was highlighted when Burt Rutan’s SpaceShipOne made its second flight to win the Ansari prize of \$10 million. The first suborbital tourist flight may take place by 2011, and costs could be reduced in time by a factor of 10.

By 2020, space tourism could become roughly comparable to air travel in cost, safety, and comfort. One entrepreneur said, “Business is starting to look hard at space tourism; they don’t want to miss an opportunity.”

## Space Race

COMMERCIAL SPACE TRAVEL VENTURES HEAT UP

- 1 The U.S. F.A.A. approved building private space launch facilities in New Mexico, Oklahoma, Texas, and other states and nations. New Mexico has a \$225 million contract to provide launch facilities for Virgin Galactic. **Richard Branson’s** company that has thousands of clients ready to take suborbital flights for \$200,000. Virgin Galactic broke ground on their **\$300 million** Spaceport America launch facility and also tested the mother ship that will carry the spaceship itself to launch. The first flight is scheduled for 2011, and Rutan is designing a stretch version of **SpaceShipOne** that can hold 10 people. The president of Virgin Galactic said, “We’re pretty confident the era of commercial space is rapidly coming.” (TechnologyReview, 5/15/06; Washington Post, 9/5/09)
- 2 Private firms are being assisted by NASA’s **Commercial Orbital Transportation Services** program, which is intended to help the private sector build capabilities to handle transport to the International Space Station (I.S.S.) and other nearby destinations. **Space X** launched the first commercial rocket into space successfully in 2010—the Falcon 9 is a reusable spacecraft that will supply the I.S.S. One politician called it “the dawn of a new era.” Orbital Sciences is building a cargo ship. Sierra Nevada Corp is developing the Dream Chaser to service satellites. (TechnologyReview, 9/2/10)
- 3 **Space Adventure Company** have partnered to build a space taxi for tourists. Space Adventure is also planning to take tourists to the International Space Station for \$20 million, and around the Moon for \$100 million. They claim to have **1,000 clients**. (Technology Review, 9/2/10)
- 4 Billionaire **Robert Bigelow** is spending \$500 million to build a **space hotel** using designs for the International Space Station. Two inflatable modules have been launched, and a habitable module with life-support systems and maneuverability is expected to be operational by 2014 (space.com, 8/14/07). He is also planning a cruise ship that will take tourists to the moon. The chief scientist at NASA says, “We need more Bigelows.” Virgin Galactic, Hilton Hotels, British Airways, and others are also working on space hotels. (TechnologyReview, 9/2/10)
- 5 The Russian company **Orbital Technologies** is planning to build, launch, and operate the world’s first commercial space station. The station will be used by professional crews and corporate researchers to conduct scientific experiments, as well as private citizens looking for an out-of-this-world holiday destination. (GizMag, 11/1/10)
- 6 The German TALS Institute is the first in Europe to develop a space tourism effort: the **Project Enterprise** is expected to carry one pilot and five passengers into space by 2011. (Wikipedia)

# FASTER THAN A SPEEDING QUBIT

Sooner than you think, quantum computers will be able to harness the power of atoms to perform processing tasks that will turn current silicon-based computers into relics

BY ANN WANG AND JIM KADTKE (TEHCAST.ORG)

Quantum mechanics offers another possible successor to silicon in which information is stored and managed using atomic particles. The unusual behavior of matter at the quantum level makes this computational technique revolutionary. Although the field is struggling to mature, promising advances are occurring each year, and applications are appearing already. Reliable quantum computers may thus be available within one to two decades, with vast scientific and commercial potential.

The basic unit of quantum computing is a “qubit”—the state of an electron spinning in either clockwise or counterclockwise rotation, representing a 0 or a 1. Because superposition allows atoms to exist in two places simultaneously, altering the state of an electron can produce two qubits, two electrons can produce four, three electrons eight, and 20 electrons could perform a million computations instantaneously.

This exponential growth offers the potential of

producing infinite processing power and infinite storage. A quantum computer could easily complete in seconds a task that takes a silicon computer billions of years (WIKIPEDIA: QUANTUM COMPUTING). Research at the University of Bristol shows quantum computers may soon be able to execute complex calculations. The breakthrough involves a specially designed optical chip to perform what’s known as a “quantum walk” with two particles. One of the researchers said: “A quantum computer could, in less than ten years, be performing calculations that are outside the capabilities of conventional computers” (GIZMAG, 9/16/2010). IBM has demonstrated the ability to store one bit on a single atom; in comparison, hard drives use one million atoms to store one bit of information. Using this technology, an entire supercomputer could be the size of a speck of dust (EETIMES, 8/30/07)

Dave Evans, chief futurist at Cisco, predicted: “The first commercial quantum computer will be available by mid-2020.” (SYNC-BLOG.COM, FEB 2010) □



## Guessing Games

Few industries have advanced as exponentially as gaming. A decade from now, the experience will be even more social and transformational, but will it be just as mind-numbing?

BY JAMES GABRILLO

Say what you want about 3D today—silly glasses, expensive technology, motion sickness—but a decade from now it shall pave the way for a revolution in the gaming industry: interface design. Goodbye to boxy console sets, handheld controllers, and game discs; instead, we’ll be using our body’s natural gestures and movements to augment and interact with the elements of our physical environment, such as home entertainment systems, air travel, and even theme parks.

Nintendo, Sony, and Microsoft will remain relevant industry movers. However, thanks to digital distribution in the

virtual marketplace, mainstream blockbusters will be going head-to-head with small, experimental “independent” titles, in the same way that the Web has leveled the playing field for movies, television, music, and of course, publishing.

Developers will focus on all-encompassing gameplay mechanics: delivering full gaming experiences that transform life’s everyday tasks into meta-games of quests and missions. Study for x number of hours, and you’re awarded x number of points. Blink an eyelid and advance to the next level.

Today, millions are caught in the Web, playing interactive

games with each other. Tomorrow, everyone will be playing together. The powerful integration of gaming and social media will play a big role in the way people define themselves. Expect a new wave of reality TV shows featuring game boys and girls competing from the comfort of their respective play stations—couches, office desks, automobiles—while interacting with the viewers in real time.

Gaming will be an even more widespread, mass market, global cultural product. Whether it will help us humans communicate in a more humane way remains to be the final fantasy. □

► AGRICULTURE

## FOOD FOR THOUGHT

**Antoine Huguenaer** dispels the current gloom over world hunger and foresees that agriculture could eventually keep pace with population growth

In the 18th century, Thomas Malthus, a British clergyman and economist, wrote about population growth and the impossibility of feeding his billion fellow inhabitants. History proved him wrong because new farmable land was used and new farming techniques were invented. This year, there will be over seven billion people on earth. In the meantime, 700 million people suffer from malnutrition, a number that should not improve significantly in the near future. So, how do we manage to feed 7.7 billion in 2021?

### Food safety and planet care

Agriculture is facing great challenges for the years to come, since farmable land is becoming a rare commodity that is unequally distributed amongst countries and continents. As the most productive lands are rapidly deteriorating (**15% of the farmable land is already unusable**), new ones are becoming more rare and will anyway have smaller yields. The quality of farm products is also a major issue, as the use of chemical products, though having allowed the yields to grow, comes with health and environmental side effects.

### A global game of monopoly?

The run for land will thus accelerate. Countries with too little farmable land and a growing population and economy to feed—such as China, Japan, India, and Saudi Arabia—are buying it from states like Indonesia, the Philippines, and Pakistan, bringing up the question of sovereignty and food security in these countries. In 2009, a **South Korean** project of renting farmable land caused a riot in **Madagascar**, and it could happen again in several places throughout the globe. Meanwhile, the global demand for agricultural commodities is rising due to increasing **food, animal husbandry, and biofuel** needs. Prices on global markets are therefore fluctuating considerably, and mostly rising. In 2008, **hunger riots** occurred in 35 countries, as people couldn't afford daily goods, such as cereals, rice, and milk. Will we have to choose between climate change or hunger and revolutions?

### The next green revolution

The answer is neither: what we have to do is support an even greener revolution based on techniques that already exist and are more productive, as well as eco-friendly (organic fertilizers, combined crops, light plowing, biotechnologies, secure genetically modified crops). And markets have to simultaneously be organized in order to limit costly price variations and to ensure food security to the millions suffering from hunger and malnutrition. It's time to prove that old Malthus wrong once again. □

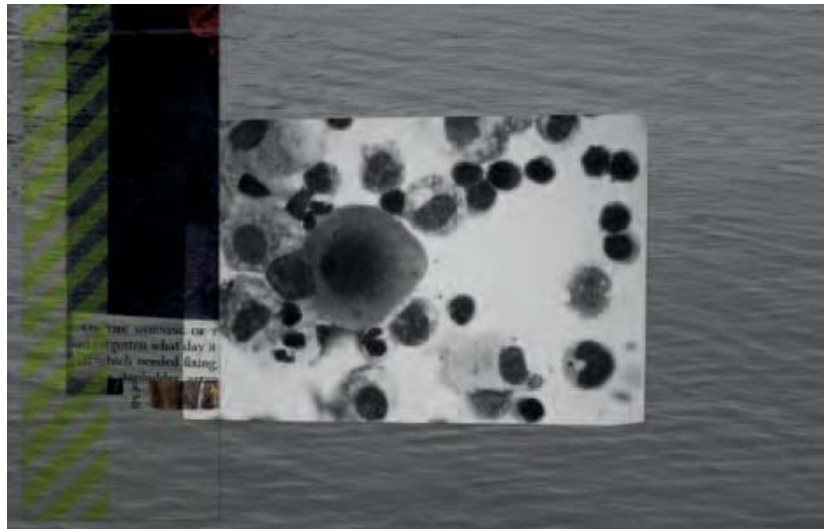
► MEDICINE

## I'm with Cancer

Is there really hope? Some experts predict that cancer patients may get a chance at a normal lifespan within the next decade or two

BY WILLIAM E. HALAL AND DEVIN FIDLER (WWW.TECHCAST.ORG)

Currently only a few cancers are curable, and that is often dependent on early detection (CNN, 3/09). New research and enhanced treatments continue progress toward changing cancer from a life threat to a chronic illness that is manageable. For instance, 81% of women diagnosed with breast cancer are alive 10 years later. Nanotechnology, better drugs, and molecular biology are producing hundreds of far more sophisticated treatments that are selective, noninvasive, and safe. Nanotech agents are especially promising because they are able to seek out cancer cells, they are small enough to enter cells and destroy them, and they are safely removed later by the kidneys (PHYSORG.COM, 1/4/10).



## Better Believe It

CURRENT RESEARCH IS DEVELOPING A MULTIPRONGED ATTACK AGAINST CANCER CELLS ONCE THOUGHT TO BE INVINCIBLE

- 1 Scientists at the **University of California** are using nanotechnology and microbiology to build "cargo ships" 50 nanometers wide that flow through the bloodstream. The hull of the ships is made of lipids designed to evade the body's immune system, and the surface is covered with molecules that attach to cells and penetrate them. The cargo consists of a **nanoparticle** and a **quantum dot** that track movement on M.R.I. scanners and the anti-cancer drug **doxorubicin** targeted to destroy tumors. Plans are underway to "zip-code" the ships so they will seek out specific types of cancer. (PHYSORG.COM, 9/15/08)
- 2 **Carbon nanotubes** can act as tiny **lasers** when exposed to infrared energy and release heat to destroy cancer cells. (SCIENTIFICAMERICAN.COM)
- 3 The genetic sequencing of cancer mutations and the development of **less expensive sequencing** technologies have allowed scientists to begin to **data-mine** tumors for their **molecular properties** in order to find individualized treatments. (TECHNOLOGY REVIEW, 9/13/10)
- 4 Researchers have developed an **embryonic genetic therapy** that can make mice totally **resistant** to cancer. Injecting their white blood cells into other mice with cancer **completely killed** the cancer cells. (WIRED SCIENCE, 11/28/07)
- 5 Better drugs are appearing. **Tarceva, Olaparib, and Avastin** are being used to **shrink tumors 90%**. A vaccine for pancreatic cancer raised two-year survival rates from 15% to 76%. **Statin drugs** used to treat cholesterol and heart disease are also effective in **preventing cancer**. The drug **DCA** has been shown to kill all forms of cancer cells while **not harming** healthy cells. A new drug blocks a genetic mutation that causes melanoma, a deadly skin cancer with few treatments presently; "It's a spectacular example of how genomic-targeted therapies are beginning to help cancer patients," said an oncologist. (TECHNOLOGY REVIEW 8/25/10, 6/25/09; NEW SCIENTIST 1/20/07)