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IEEE

BRIEFINGS

REGION NEWS

REGION 3 SOUTHEASTERN UNITED STATES

■ **Charlotte (N.C.) Section** forms Women in Engineering (WIE) affinity group.

REGION 4 CENTRAL UNITED STATES

■ Student branch formed at **ITT Technical Institute,** in **Orland Park, Ill**.

REGION 5 SOUTHWESTERN UNITED STATES

■ **Central Texas Section** establishes IEEE Computer Society chapter.

REGION 6 WESTERN UNITED STATES

■ **Phoenix Section** establishes WIE affinity group.
■ **Fort Huachuca (Ariz.) Section** forms WIE affinity group.
■ **Orange County (Calif.) Section** establishes IEEE Components, Packaging, and Manufacturing Society chapter.
■ **San Diego Section** forms IEEE Product Safety Engineering Society chapter.
■ WIE affinity group formed at **Stanford University.**

REGION 7 CANADA

■ **Newfoundland Labrador Section** forms joint chapter of IEEE Computer, Communications, and Circuits and Systems societies.
■ **Canadian Atlantic Section** forms joint chapter of IEEE Robotics and Automation and IEEE Instrumentation and Measurement societies.
■ **Northern Canada Section** forms joint chapter of IEEE Microwave Theory and Techniques and IEEE Antennas and Propagation societies.

REGION 8 EUROPE, MIDDLE EAST, AND AFRICA

■ **Switzerland Section** forms Graduates of the Last Decade (GOLD) affinity group.
■ **Italy Section** forms IEEE Oceanic Engineering Society chapter.
■ Student branch at **Queen Mary, University of London,** forms WIE affinity group.
■ **Sweden Section** forms GOLD affinity group.
■ **Cyprus Section** forms IEEE Computational Intelligence Society chapter.
■ **Russia Section** forms IEEE Computer Society chapter.
■ **Republic of Macedonia Section** forms IEEE Information Theory Society chapter.
■ **Turkey Section** forms IEEE Systems, Man, and Cybernetics Society chapter.
■ Student branch at **Dumlupinar University, Kütahya, Turkey,** forms IEEE Computer Society chapter.
■ Student branch at **American University of Science and Technology, Beirut, Lebanon,** forms IEEE Engineering in Medicine & Biology Society chapter.
■ Student branch formed at **Arab American University, Jenin, Palestine.**
■ Student branch formed at **Al Ghurair University, Dubai.**
■ Student branch formed at **National Research University of IT, Mechanics and Optics, St. Petersburg, Russia.**

REGION 9 LATIN AMERICA

■ **Brasília (Brazil) Section** forms IEEE Communications Society chapter.
■ Student branch formed at **Universidade Federal de Santa Catarina, Florianópolis, Brazil.**
■ **Rio de Janeiro Section** forms IEEE Computational Intelligence Society chapter.
■ **Bahia (Mexico) Section** forms IEEE Computational Intelligence Society chapter.
■ Student branch at **Universidad Autonoma de la Ciudad de Mexico, Mexico City,** forms IEEE Computer Society chapter.
■ Student branch formed at **Instituto Tecnológico Superior del Oriente del Estado de Hidalgo, Apan, Mexico.**
■ Student branch formed at **Universidad Nacional Santiago Antúnez de Mayolo, Huaraz, Peru.**
■ Student branch at **Universidad Privada Antenor Orrego, Trujillo, Peru,** establishes IEEE Robotics and Automation Society chapter.
■ **Nicaragua Section** forms IEEE GOLD affinity group.
■ Student branch formed at **Universidad Tecnológica de Honduras, Cortes.**

REGION 10 ASIA AND PACIFIC

■ **Gujarat (India) Section** forms WIE affinity group.
■ WIE affinity groups formed by student branches in India at **Muffakham Jah College of Engineering & Technology, Banjara Hills,** and at **Gokaraju Rangaraju Institute of Engineering & Technology, Miyapur.**
■ **Pune (India) Section** forms IEEE Computer Society chapter.
■ Student branches formed in India at **Dr. Pauls Engineering College, SRM University, International Institute of IT, Rajarambapu Institute of Technology, Gurukul Institute of Engineering and Technology,** and **Guru Nanak Engineering College.**
■ **Hyderabad (India) Section** forms IEEE Computational Intelligence Society chapter.
■ **Hyderabad Section** forms **IEEE Vizag Bay Subsection.**
■ **Kharagpur (India) Section** forms GOLD affinity group.
■ Student branch at **Indian Institute of Science, Bangalore,** forms IEEE Communications Society chapter.
■ **Islamabad Section** forms IEEE Computer Society chapter.
■ Student branch at **Usman Institute of Technology, Gulshan Iqbal, Pakistan,** forms WIE affinity group.
■ **Indonesia Section** forms IEEE Computer Society chapter.
■ **South Australia Section** forms Life Members affinity group.

SEND US YOUR NEWS

We publish these announcements of new groups once they've been approved by IEEE Member and Geographic Activities. To send us other local news, like student branch events and competitions, WIE or preuniversity outreach efforts, or other IEEE group activities, use our new form on the Region News page at http://theinstitute.ieee.org/region-news.

COVER: JUDE BUFFUM. THIS PAGE: ISTOCKPHOTO

Online

Available 6 December at theinstitute.ieee.org

NEW PUBLICATIONS
Learn which IEEE journals will soon debut.

STANDARDS
Read about the IEEE Standards Association's work with virtual worlds.

NEWS

Top Five Ways to Improve IEEE

HERE ARE THE top recommendations for IEEE, worded exactly as they were voted upon by the 294 primary section delegates during IEEE Sections Congress, held 19 to 22 August in San Francisco.

- IEEE to develop a comprehensive long-term strategy to increase the number of next-generation youth pursuing science and engineering careers.
- As members maintain their IEEE membership over their years, IEEE must reward them for their loyalty. Rewards ought to be tangible and useful and can be done simply and inexpensively. Create Global Fidelity programs including: (a) continued membership recognition for 5-10-15-20 years of membership (b) bonus for specific benefits (e.g., reduced fee, IEEE merchandise, etc.).
- IEEE membership (including e-membership) should include a society membership as part of the basic membership fee.
- Increased support to students in technical activities with grants to attend conferences and organization of technical competitions.
- To encourage interest in pre-university students in engineering careers, IEEE to publish a subscription periodical (paper or electronic) targeted to high school students that highlights engineering activities of interest to those students. The periodical should also have articles promoting the benefits of an engineering career and what the students can do in college to get involved with IEEE.

IEEE Establishes Social Media Policy

THE BOARD OF DIRECTORS has approved the IEEE Social Media Policy, which covers the use of social media on behalf of or associated with IEEE. It defines social media as "any websites, portals, or other digital-based applications that allow individuals to post and share content publicly and which allow other individuals to view, respond to, and share this content further." The policy, which was approved at the board's August meeting, is aimed at IEEE members, volunteers, employees, vendors, consultants, and contract workers. IEEE's social media best practices include:

- When someone mentions IEEE in a recommendation, referral, or opinion, it must be noted that he or she does not represent or reflect the views of IEEE.
- Individuals should never impersonate someone else, or intentionally obscure their identities or associations with IEEE.
- When quoting someone, citations traceable to that person should be provided.
- If images are used, they must not violate copyright laws or trademark rights.

Other best practices involve responding to comments in a timely and professional manner and correcting inaccurate information.

The policy includes guidelines for IEEE site operators and administrators, including how to register their site so they will be added to an official list of IEEE social media pages. Read the full policy at http://www.ieee.org/about/social_media.

CALENDAR

December

1 1941: Birth date of **Federico Faggin**, inventor of the Z80, an 8-bit microprocessor that dominated its market from the late 1970s to the mid-1980s.

3 1924: Birth date of **John Warner Backus**, an IBM Fellow who helped develop several computer languages, including FORTRAN and ALGOL.

7 1972: ***Apollo 17***, the final moon mission of NASA's Apollo program, is launched from Cape Canaveral, Fla.

10 1901: **The first Nobel Prizes** are presented by the King of Sweden, in accordance with inventor Alfred Nobel's will.

17 1903: Wilbur and Orville Wright complete the first successful **motor-powered and piloted airplane flight** at Kill Devil Hills, N.C.

January

3 1906: The first **two-way trans-atlantic wireless telegraphy** is initiated between Brant Rock, Mass., and Machrihanish, Scotland.

8 1914: Birth date of **Thomas John Watson Jr.,** IBM's president from 1956 to 1974.

9 1894: New England Telephone and Telegraph (an early predecessor of AT&T) puts the first **battery-operated telephone switchboard** into operation.

17 1706: Birth date of **Benjamin Franklin**.

21 1904: The first **military radio experiments at the Eiffel Tower** are conducted. Gustave Eiffel offered the French army use of his structure to save it from destruction after its initial permit expired.

28 1886: Birth date of **Hidetsugu Yagi**, whose eponymous directional shortwave antenna is now an IEEE Milestone.

February

1 1972: Hewlett-Packard introduces the **HP-35 pocket calculator**, the first to compute trigonometric functions and logarithms.

6 1959: Jack Kilby files a patent application for the **integrated circuit**. He received the 2000 Nobel Prize in Physics for its invention.

14 1876: Alexander Graham Bell files a patent application for the **telephone**.

17 1911: Charles Kettering delivers his **electric starter** to Cadillac Motor Co. in Detroit. It debuts in 1912 and is rapidly adopted by other auto makers to replace hand-cranked starting.

15–21 IEEE Meeting Series in Phoenix.

28 1837: Birth date of **Herman H. Hollerith**, inventor of punched-card equipment for data processing and founder of Tabulating Machine Co., a predecessor of IBM.

Historical events provided by the IEEE History Center. IEEE events indicated in red.

CLOCKWISE FROM LEFT: ISTOCKPHOTO (2); ZILOG; HITACHI KOKUSAI ELECTRIC; HEWLETT-PACKARD; DAVID LIU/ISTOCKPHOTO; NEW ENGLAND TELEPHONE AND TELEGRAPH

CAREER GUIDANCE

Making the Jump Into Games

Three members share advice for entering a fast-growing industry

BY ANIA MONACO

WHILE SOME industries are cutting jobs during these difficult economic times, others are growing so fast they can't find enough workers. One such field is the video-game industry. Despite occasional slumps, video- and computer-game sales have been climbing for several years, and that trend is likely to continue, according to many analysts. Game-related spending by consumers is expected to reach US $112 billion by 2015, up from $67 billion last year, according to a study in July by Gartner, a technology research company.

Recent sales successes have been unprecedented. Activision's *Call of Duty: Black Ops*, a first-person shooter game, this year set a record when it brought in more than $650 million during its first five days on the market. Also this year, Microsoft's Kinect—a real-time motion-capture add-on to the Xbox 360—established a record in the first 60 days of its launch, becoming the *Guinness Book of World Records*' "Fastest-Selling Consumer Electronics Device" of all time.

Fueling the industry's growth is the popularity of smartphones, tablet computers, and other portable devices that run game apps. Mobile game sales are expected to jump from 15 percent of all games in 2010 to 20 percent in 2015, according to the Gartner report.

So, how can you get involved in this booming industry? Three IEEE members who are also game developers shared their advice with *The Institute*. IEEE Member Nicholas Peterson is founder of and senior developer at VisionaryX, a game development studio in Schönaich, Germany. Member David Callele, a consultant on product requirements, is founder of Experience First Design, a studio in Saskatoon, Sask., Canada. Member Simon Lui founded EC2 Hong Kong, an iPhone/iPad app developer.

COMPUTER SCIENCE

Education is important for aspiring game developers, but few universities offer a major in the field. Rather, if you want to work in the game industry, "you should have a degree in any computer science or sound- or light-engineering-related field," Peterson says. "But people with backgrounds in sociology, physics, art, design, and business are also needed." He earned a bachelor's degree in computer science and then spent 20 years in the IT industry working on software development and consulting before starting his company. "Systems engineering, programming, and project management courses also helped me," he adds.

Computer science is also the path Callele took. He received bachelor's degrees in electronics and computer science and then earned a master's and a doctorate in computer science, specializing in requirements for video-game design. "A solid academic base coupled with practical experience in high-reliability software design and implementation gave me the tools I needed to enter the industry," he says. "I started out by debugging new products for middleware developers and doing technical writing—like for documenting software-development kits—which demonstrated that I was not just technically competent but also an effective communicator."

Lui earned a Ph.D. in computer science but learned app development mostly on his own. "When I started working as an app developer in 2008, it was not such a popular area, so there were no tutorials available," he says. "I learned from the materials and application programming interface provided by Apple. Developing apps is mostly a self-taught process." But nowadays students have many more resources, he points out. Stanford University, for example, offers a free iPhone Apps development course, available through iTunes U.

Would-be game developers might want to consider an alternative to a typical four-year university, Peterson suggests. "One of the key weaknesses of our traditional education system is the difficulty of keeping up with the top-of-the-line technologies used in a growing, fast-paced industry like gaming," he says.

Private technical schools and game development academies could be another way to go. "The advantage of these schools—which usually offer one-, two-, or three-year programs highly focused on a particular area—is that students finish with a certificate or perhaps even a bachelor's degree that is specifically in game development and have usually been taught by people from industry using the most current tools," Peterson says. For example, students at the Games Academy in Berlin use the complex CryEngine, a game-development tool. The engine was created by Crytek, a video-game company that used it to develop its first-person shooter *Crysis*, hailed by gamers for its realistic graphic design.

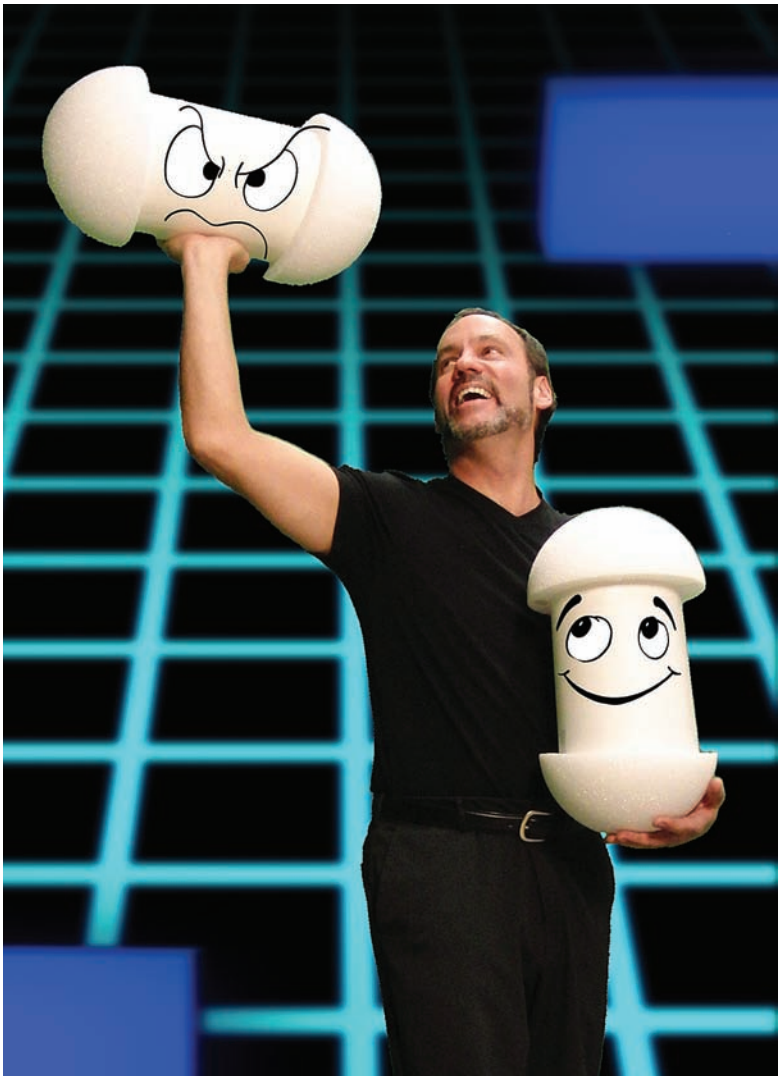
Top: App developer Simon Lui. Bottom: Screen shot from A Knights Dawn, *a mobile game developed by Nicholas Peterson's studio.*

A common drawback of such alternative schools, Peterson notes, is that they lack in-depth teaching of the more general topics also needed in the game industry, such as project management, higher mathematics, and process engineering. "And since there is no R&D tied to these schools, their knowledge base doesn't grow each year," he adds.

MATH AND MORE

What are game- and app-development companies looking for in job candidates? The short answer is a variety of technical skills, plus creativity.

TOP: MATHIEU PUIGT; BOTTOM: VISIONARYX



David Callele holds two characters, Beep and Bop, from his company's upcoming game.

"Fundamentally, you must be competent—if not really good—at almost everything," Callele says. "Make sure your basics, like programming, are very solid. Game-development technology is changing rapidly, and your basics will give you what you need to be able to adapt and continue learning."

It takes a diverse team to make a game, including programmers, sound engineers, and graphics artists. "Graphics engineers and artists need to know about graphics layers, physics, lighting simulation, 2-D and 3-D representation, and their related sciences," Peterson says. "Sound engineers need to know analog-to-digital technologies."

"The greatest demand right now is for extremely talented 3-D artists and programmers," he continues. "But the pay is not anywhere as good as what one gets in the more traditional IT industry."

No matter what type of job you're looking for, you must excel in math. "From the basics of statistics to very complex artificial intelligence algorithms, game programmers and designers need to understand and be able to use math in many forms," Peterson says.

Adds Lui, "Creativity is essential. You need to have novel ideas for games and apps before others come up with them."

One way to score points with a potential employer is to develop a game, Callele says: "A lot of people say they want to get into the game industry but are not willing to show that they can deliver." He also suggests signing up to be a beta tester for a game; companies often issue calls for volunteers. "Then demonstrate that you can be thorough by delivering a useful report to the development team," he says.

And as with most industries, experience is key. "The easiest way to get into the game industry is to apply for summer jobs or internships," Peterson says. "If you have been developing games as a hobby, great. But unless you have something amazing to show someone, no one will be very interested unless you've worked in the industry."

AREAS IN DEMAND

You're in luck, Lui says, if you're interested in developing mobile games, like those for the Apple app store. "It's very hard right now for app companies to find enough talented iOS app developers," he says. "Worldwide, there are only 43 185 people registered through Apple's iOS developer program, and many go on to start their own businesses." Hone your programming skills first and foremost, Lui tells job seekers. "You'll need a good programming background and an understanding of how to write mobile applications. And be ready to learn new things, because app markets are always changing."

There's no better time than now to get into games, Callele, Lui, and Peterson agree. "The opportunities for delivering enjoyable experiences to gamers are growing like crazy," Callele says. "Games that blend the physical and virtual worlds [like those on the Nintendo Wii and ones that use Kinect] are cool. I think we're just starting to explore what multiplayer is all about for games outside the first-person shooter and role-playing genres."

Mobile games will continue to rise in popularity, Lui says. "More and more people need games on the go—people are playing games on trains, planes, and just about everywhere."

"From a business standpoint," Peterson says, "the industry is moving more into the mainstream. With increased R&D going into new areas, games will continue to grow and grow."

BE YOUR OWN BOSS

Many are drawn to the field because game and app development offers opportunities to launch start-ups. Lui decided to create his own app development company after using an iPod Touch for a year and not finding the apps he needed. "I decided, if I can't find it, why don't I develop it myself?" he says.

In 2008 he unveiled his first app, ec MTR, to display schedules, ticket prices, and other information about Hong Kong's rail system. On the day it launched it became the best-selling travel app in the Hong Kong Apple app store. He since has developed many others, including games, apps for digital musical instruments, and ones for signal processing research. Each of his apps sells for between US 99 cents and $1.99. Apple and its app developers share app sale revenues in a ratio of 3 to 7, Lui explains.

Callele founded Experience First Design in 2009 because of his love of video games. "I've always been drawn to video games because I'm fascinated by what I think of as the art of making people happy," he says. "Being able to create a complete virtual reality for someone to experience is such a rush!" He cites a number of personal factors that can help you succeed: "I am blessed with a strong sense of self, confidence in my abilities, and the stamina to work long hours while maintaining my health and my perspective."

He is working on developing his company's first multiplayer games for devices "with computing capabilities at the smartphone level and greater," Callele says. Some of the games are inspired by classic video games like *Pong*. "Our version takes the gameplay to a whole new level—pun intended," he says.

Peterson founded VisionaryX last year with his son, a graphic designer, while working at Hewlett-Packard. After deciding to develop strategy and defense games, they pulled together a team that included a lead developer, a 2-D artist, and a marketing and public relations professional. They outsourced the animation and sound. Their first game, *A Knights Dawn*, was released in the Apple app store in May.

"A question I get asked frequently is, 'What kind of money does it take to start a game company?'" Peterson says. "If you want to succeed, plan on needing to pay your own and your team's way for at least one year" before seeing much of a return.

But there's a lot more to starting your own development studio than money. "From the business side, you naturally need to take courses in business management, intellectual property rights, and property law," Peterson says. "From a leadership side—and this is really a tough one—you need to understand how to lead well-qualified but extremely creative and talented individuals, as well as how to forge a successful team."

Read more in this issue to learn about the history of the game industry and how IEEE's products, services, and conferences can help you get involved. ■

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Advancing Technology for Humanity

From Pong to PlayStation 3

Video games through the years

BY ANIA MONACO

GAME CONSOLES—like today's Xbox 360, Nintendo Wii, and PlayStation 3—have come a long way from their humble beginnings, when a white dot bounced back and forth somewhat forlornly across an oscilloscope screen. Today's video and computer games include graphically impressive first-person shooters such as *Crysis 2* and *Call of Duty: Black Ops*. Others, like *Dance Central* on Microsoft's Xbox 360 with Kinect, apply real-time motion-capture technology to turn the player's body into the controller.

To explore the game industry's dramatic history, *The Institute* enlisted the help of the IEEE History Center, IGN.com, and other online resources. The story is filled with flops as well as breakthroughs. Somehow, the game industry always bounces back and continues to grow.

EARLY PIONEERS

The first video game can be traced to 1948, when Thomas T. Goldsmith Jr. and Estle Ray Mann were issued a U.S. patent for a "cathode ray tube amusement device." A machine with a knob (for aiming) and button (for shooting) was used to fire at airplane targets. Because of equipment costs, among other factors, the game was never manufactured; only a few handmade prototypes were passed around.

Ten years later, physicist William Higinbotham developed *Tennis for Two*, a game that added an analog computer to an oscilloscope. The opposing players each had a box equipped with a knob that controlled an on-screen paddle for angling where a ball was to go, and a button for hitting the ball.

In 1961, a group of MIT students wrote a program for their DEC PDP-1 computer, called *Spacewar!* It was for two players whose squadrons of opposing spacecraft fired missiles at each other. If yours was the last craft firing, you won. The game, eventually distributed as a premium with new DEC computers, was simple and fun to play.

ARCADES, ATARI, PONG

In the early 1970s, coin-operated video arcade games began popping up, including a version of *Spacewar!* called *Computer Space*, developed by engineers and entrepreneurs Nolan Bushnell and Ted Dabney, who went on to found Atari in 1972. The company had just one other engineer, IEEE Life Member Alan Alcorn, and a modest lab.

"Compared to the lab that we had at Ampex [a tape-recorder manufacturer where Alcorn had worked], Atari was very humble, with just one old oscilloscope," Alcorn wrote in his firsthand account, "The Development of *Pong*: Early Days of Atari and the Video Game Industry." (The document is posted on the IEEE Global History Network.) "It was an eye-opener to see that you could start a company with such simple stuff."

Bushnell asked Alcorn to develop an arcade version of a Ping-Pong game after seeing a demonstration of a tennis game on the Magnavox Odyssey, the first home video-game console. The result—*Pong*—was released in 1972, and its popularity helped launch the modern video-game industry.

"Nothing like this had ever been done before," Alcorn wrote. "There were two knobs and a coin box." *Pong*—a table tennis game, with each knob controlling a "paddle"—became the first commercially successful video game.

Atari released a home version in 1975. Its success led many other companies to release clones. Eventually, there were so many copies—and lots of bad ones—that they led to the crash of the video-game industry in 1977. When consumers balked at buying the junk, most of the *Pong*-clone companies went bust.

The late 1970s and early '80s was a great time for arcades, however. By 1981, arcade games—which had expanded to include *Battlezone*, in which players destroy tanks drawn in green lines on a black screen, and the popular alien-shooting *Space Invaders*—were pulling in about US $5 billion each year in North America alone. Color arcade games soon began appearing, like the smash hit *Pac-Man*, which featured a yellow face gobbling pellets while avoiding ghosts.

William Higinbotham develops Tennis for Two.

Ralph Baer and colleagues at Sanders Associates finish their Brown Box prototype, the first home video-game console.

1958 — 1968

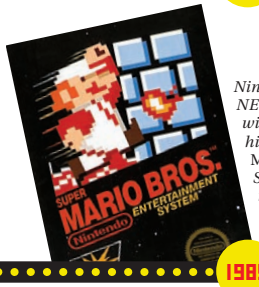
ColecoVision, packaged with Donkey Kong, *comes out.*

Mattel launches its Intellivision console.

1982 — 1980

Atari releases E.T., *considered by critics to be among the worst video games of all time.*

A glut of bad games leads to an industry crash.



Nintendo's NES launches with breakout hits like Super Mario Bros. *Sega launches its Master System.*

1982 — 1983 — 1985

Sega launches its last console, the Dreamcast, the first to have a built-in modem for online play.

The 64-bit Nintendo 64 is released, but the company loses its leading position.

1998 — 1996

Sony's PlayStation 2 hits store shelves and becomes the all-time best-selling console.

Microsoft enters the market with its hit Xbox and the system's sci-fi first-person shooter, Halo: Combat Evolved.

Nintendo's new handheld, the DS, and Sony's rival to it, the PSP, are introduced.

2000 — 2001 — 2004

Magnavox licenses the Brown Box, selling it as the Odyssey. Atari is founded and Pong *is released.*

Atari releases a home version of Pong.

1972

1975

Atari releases the Video Computer System, later renamed the 2600.

Fairchild Semiconductor launches the Video Entertainment System (later named Fairchild Channel F).

1977

1976

Legend of Zelda *comes out, spawning a long series of popular games.*

Sega's 16-bit Mega Drive is introduced, becoming the company's most successful system.

Nintendo's handheld Game Boy hits the market.

1986

1988

1989

32-bit consoles like the Sega Saturn, Sony PlayStation, and NEC PC-FX launch.

Sega's hit Sonic the Hedgehog *and the 16-bit Super Nintendo come out.*

1994

1991

Xbox 360 debuts.

Playstation 3 and Nintendo's Wii launch.

Motion control is reinvented with Microsoft's Kinect add-on.

2005

2006

2010

PHOTOS, CHRONOLOGICALLY FROM TOP LEFT: BROOKHAVEN NATIONAL LABORATORY; MARK RICHARDS; ATARI; COMPUTER HISTORY MUSEUM; SSPL/GETTY IMAGES; COMPUTER HISTORY MUSEUM (2); ATARI; NINTENDO (2); WILLIAM WARBY; SEGA; EVAN AMOS (3); MICROSOFT; EVAN AMOS; FLOREA MARIUS CATALIN/ISTOCKPHOTO; SONY COMPUTER ENTERTAINMENT; MICROSOFT

CONSOLES AND COMPUTERS

Credit for the first home video-game console goes to Ralph Baer, who came up with the idea in the 1950s while working on TV equipment at Loral Electronics, in New York City. But Loral, a defense contractor, wasn't interested in a game, so it wasn't until 1968 that Baer and his colleagues at Sanders Associates, in Nashua, N.H., finished a prototype called Brown Box. It ran games off printed-circuit-board cartridges that controlled switches to alter the circuit logic. The system, which was soundless, included clear plastic overlay sheets that could be taped to the player's TV screen to add color, playing fields, and other graphics.

The system was licensed to TV set maker Magnavox, which named it the Odyssey, and the company began selling it in 1972 in the United States. Some 100 000 units were sold the first year. The Odyssey's offerings included football, a shooting game, and a table tennis game predating *Pong*. Magnavox later sued Atari for patent infringement, saying *Pong* was a copy of Odyssey's table tennis game. The case was settled out of court.

Computer games became popular during the 1970s, many of them developed by college students using their schools' mainframes on the sly. One of the most popular was *Star Trek*, a spin-off of the TV show in which users typed commands to control the *USS Enterprise* on a mission to destroy Klingon warships. There was also an early first-person shooter game called *Maze War* and a slew of digital clones of the popular tabletop role-playing game *Dungeons and Dragons*. Computer-game sales continued to grow in the late '70s and early '80s as more people bought home computers such as the 8-bit Commodore 64.

SECOND-GEN CONSOLES

Fairchild Semiconductor in 1976 released its Video Entertainment System, later named the Fairchild Channel F. It was a breakthrough in home consoles because it was the first to use ROM cartridges, which made it possible to pause games. The Channel F's controller was a simple joystick, and the system boasted 26 games it called videocarts, including bowling, baseball, and racing.

In 1977, Atari released its Video Computer System (VCS), later named the Atari 2600. The system came with one of two titles: *Combat*, which featured 27 war games, or *Pac-Man*. The 2600 employed two joysticks and a pair of conjoined paddle controllers.

Another successful console was the Intellivision, made by Mattel in 1980; it launched with poker and blackjack games. Coleco Industries' ColecoVision, released in 1982, came packaged with *Donkey Kong*, licensed from Nintendo. *Donkey Kong* was an early version of what's known as a platform game, in which characters jump onto ledges, dodging enemies and obstacles. In *Donkey Kong*, the goal was to rescue a damsel in distress who was held by a giant ape.

But poor-quality games soon flooded the market. Among them was *E.T. the Extra-Terrestrial*, released in 1982 by Atari. Players guided the movie alien to find three pieces of an interplanetary telephone to call home. At the end, each time the player got E.T. aboard his spaceship, the game would restart. Basically, the game would end only if E.T.'s energy bar was depleted or the player quit. Partly as a result of the bad-games glut, an industry meltdown in 1983 pushed Coleco, Magnavox, and other companies out of the game business.

MARIO TO THE RESCUE

The industry made a comeback in 1985 thanks to the release of the Nintendo Entertainment System (NES). The 8-bit console came with the breakout hit platform game *Super Mario Bros.*, and the mustachioed, red and blue overall–wearing plumber soon became a household name. Nintendo dominated the industry in North America and Japan until the next generation of consoles came along in the 1990s. Helping keep Nintendo at the top was the agreement of the company's third-party game developers to produce games only for the NES. Sega launched a competitor, its Master System, in 1985 in Japan, then in North America in 1986, and in Europe a year later.

These third-generation consoles featured two controllers that had a directional pad for moving characters, known as a D-pad, and at least two action buttons. They replaced the joysticks and paddles used earlier, becoming the foundation for future controllers.

Nintendo released the blockbuster *Legend of Zelda* in 1986. The action-adventure, puzzle-solving game featured a hero named Link on a quest to save the princess Zelda. Its popularity led to a long series of Zelda games that continue to be released today. Another hit was *Final Fantasy*, which also resulted in a continuing series that made it the most successful role-playing game franchise in history.

MORE AND MORE BITS

The 1990s were important for the industry. Handheld systems like Nintendo's Game Boy, released in 1989, became increasingly popular, and a plethora of more advanced consoles hit the market.

Sega released its next-generation 16-bit Mega Drive in Japan in 1988. It debuted in North America a year later, under the name Sega Genesis. The system became Sega's most successful. In 1991, the company released one of its biggest

hits, *Sonic the Hedgehog*. Sega also released *Mortal Kombat*, a fighting game that raised eyebrows for its graphic, bloody battles.

That year Nintendo launched its 16-bit Super Nintendo, called the Super Famicom in Asia. It became the best seller of the 16-bit console era, with hits such as *Super Mario World*, *The Legend of Zelda: A Link to the Past*, and *Street Fighter 2*. Many other systems were introduced during the next few years, including the Neo-Geo, which featured advanced 2-D graphics, and Atari's last console, the Jaguar.

Soon, 32-bit fifth-generation consoles hit the market. In 1994 in Japan, three were released: the Sega Saturn, the Sony PlayStation, and the NEC PC-FX. The PlayStation had started out as a joint project with Nintendo to create a CD-ROM add-on to the Super Nintendo, but before it was announced Nintendo changed its mind and pulled out over contract concerns. Sony had no reason to cry over the split, though: The PlayStation went on to outsell all of its fifth-generation competitors. Several popular titles launched with the console, including *Doom*, a first-person shooter hailed for its 3-D graphics.

Nintendo released the 64-bit Nintendo 64 in 1996, but it failed to live up to expectations. The system used ROM cartridges, unlike PlayStation's CD format, which limited its storage capacity. Nintendo soon lost its leading position in the industry.

Still, the Nintendo 64 introduced influential games such as *Super Mario 64*, whose 3-D platform style became an industry standard. Nintendo also released the first major first-person shooter exclusive to a console, the James Bond hit *GoldenEye 007*. And *The Legend of Zelda: Ocarina of Time*, released in 1998, is widely credited as one of the best games of all time.

ENTER MICROSOFT

Sixth-generation consoles hit the market in 1998 as well, starting with Sega's Dreamcast, the first console to have a built-in modem for online play. Fighting games such as *Soul Caliber* showcased the system's impressive graphics, but the Dreamcast was Sega's last game console.

Sony released the PlayStation 2 in 2000, and the console became the all-time best seller, with 150 million units sold as of February 2011. Despite coming out with the PS3, Sony continues to make games for the PS2.

Nintendo's GameCube, the company's first disk-based system, came out in 2001. It didn't do as well as the company had expected. A contributing factor was a newcomer to the market: Microsoft. In 2001, the company released the Xbox. Shortly after, the sci-fi first-person shooter *Halo: Combat Evolved* debuted, helping Xbox sales skyrocket. The *Halo* series would come to define the first-person shooter genre.

During the past few years, the companies known as gaming's Big Three—Microsoft, Nintendo, and Sony—have all made major advances. Nintendo released an upgrade in 2004 of its popular Game Boy handheld, the DS. Sony launched a rival, the PlayStation Portable (PSP), in Japan that same year and one year later in the United States. Both companies continue to release upgrades. Nintendo's most recent, the 3DS, features a glasses-free 3-D screen. Sony is set to release its PSP successor, the PlayStation Vita, this month in Japan and early next year elsewhere.

As for Microsoft, its Xbox 360 was launched in 2005 with high-definition graphics, large hard disk–based secondary storage, online play, and the ability to download games. Sony's PS3, released in 2006, was also outfitted with those features. Nintendo, rather than focusing on better graphics and processing power, opted for something else entirely. Players using its Wii, released in 2006, control characters merely by waving their controller at a sensor placed near the screen. The console quickly sold millions and Nintendo returned to its No. 1 spot in the console wars.

Last year, Microsoft tried its hand at motion control with its Kinect add-on to the Xbox 360. Using groundbreaking real-time motion tracking, the system scans players' bodies, replicating their moves in a character on the screen. The Kinect broke the Guinness world record as the fastest-selling consumer electronics device, with more than 8 million systems sold in its first 60 days. Meanwhile, Sony released a motion controller for its PS3, called the Move.

The Big Three continue to work on their next-generation consoles. Nintendo's upcoming Wii U is supposed to have better graphics and greater processing power as well as a motion controller with a touch screen. What will the future of games bring? Stay tuned. For the video-game industry, it's far from "Game Over." ■

JOE RAEDLE/GETTY IMAGES

QUESTION OF THE MONTH

No Violent Video Games for Minors?

The U.S. Supreme Court recently struck down a California law banning the sale or rental of violent video games to minors. The court ruled that the law violated free-speech rights and that government did not have the power to "restrict the ideas to which children may be exposed." The judges noted that children are exposed to violence in many other forms of entertainment, including books and television. A violent video game was defined by the law as one that depicts "killing, maiming, dismembering, or sexually assaulting an image of a human being."

Do you agree with the Supreme Court's decision? Should governments have the authority to prevent minors from buying violent video games?

Respond to this question by commenting online at http://theinstitute.ieee.org/opinions/question. A selection of responses will appear in the March 2012 issue of The Institute *and may be edited for space. Suggestions for questions can be sent to institute@ieee.org.*

RESPONSES TO SEPTEMBER'S QUESTION

Early EV Adopters

Despite the buzz about all-electric vehicles and the US $7500 federal tax credit for U.S. purchasers, many people hesitate to buy them. Reasons cited include the cars' limited range, the lack of charging stations, the several hours it takes to charge the cars, and the possibility that severe cold as well as using the heater or air conditioner will drain the battery.

Do you plan to buy an all-electric car?

The following responses were selected from those we received at http://theinstitute.ieee.org/opinions/question/early-ev-adopters.

STILL A NONSTARTER

EVs have the same limitations now as always. Battery technology is simply incapable of providing an acceptable level of stored energy to make all-electric vehicles useful for anything other than short-range travel in urban areas. Gasoline, diesel, or other forms of fossil fuel will continue to be required for most forms of travel.

R. Craven

POWER OUTAGES

For me, an EV is next to useless. Where I live, the cold winters would significantly shorten the range of any EV. And my daily commute is about 167 kilometers round-trip, which pushes the range of most EVs. Storm-related power outages are also common in my area—most are just a few hours, but some can last up to five days. An outage of just a few hours at night could mean I would not be able to get to work the next day. If I drive longer distances on vacation or to visit relatives, I will still need a gas-powered or hybrid vehicle. The problems with an EV are more than I wish to deal with.

Mark Bailey

CHARGED UP

I am about to buy a Chevy Volt. I test-drove one, and I was very impressed. I was on an undergraduate team in college that built a series of hybrids from the ground up, so I'm interested in the powertrain setup. The Volt feels very much like a gas-powered car, except it has a wonderful torque curve and is very quiet. The test drive included depleting the battery and running in range-extension mode (using the gas engine). Most of the time, the internal combustion engine is barely noticeable, typically shutting off at very low speeds. The range and the interior space in the passenger compartment make the car very practical.

A. Russell

A GREAT COMMUTE

My Nissan Leaf was delivered in July, and it is a perfect commuting car. I've already driven it more than 5000 km, and I don't even have to charge it every night. I waited a long time for a mass-produced all-electric vehicle, and I still regret that GM's EV1 was pulled from the market after its lease period. The Leaf is a beautifully engineered car, and I would recommend it to anyone who has a reasonable commute.

Walter W. Buchanan

LONGER-RANGE BATTERY

I currently own two Toyota Prius vehicles, and I plan to buy a Chevy Volt. With the Prius I can drive all-electric for at least 17 km at street speeds of up to 56 km per hour. The Volt and Leaf can run on all-electric power at highway speeds as well, and they have larger batteries for longer range. However, I like that hybrid vehicles have backup engines so drivers won't find themselves stranded should the battery fully deplete during a trip.

Joseph Ward

SAVING THE PLANET

I plan to buy a Ford Focus Electric as soon as I can. I want to get away from burning fossil fuels and I believe this is society's big first step, though we have a long way to go. I travel more than 80 km only a few days a year, so an all-electric vehicle will meet my daily commuting needs.

I am greatly disappointed, however, in the slow progress made over the past century by electric energy storage devices. But I am hopeful that, with enough great minds working on this, the world will rapidly turn toward more sustainable energy. The decisions we make today will have a huge impact on the condition of our environment, economy, and well-being down the road.

Charles

PRESIDENT'S COLUMN

IEEE in Africa: *Ke Nako!* (It's Time!)

I AM WRITING this column on the eve of the 10th IEEE Africon conference which, when you read this, will have taken place in Livingstone, Zambia, in September. Africon, the premier technical conference on electrical engineering, systems engineering, and computing in Africa, was devoted this year to sustainable energy and communications development.

Africa has been on my mind (and on the minds of many of my IEEE colleagues) for quite some time because expansion into the continent is an important challenge for our organization. We still do not have many members in Africa—fewer than 6000, of which about 2000 are students. We are looking at Africa because it is an up-and-coming, economically expanding region, showing GDP growth well beyond the stagnant rates that it experienced in the last three decades of the 20th century and even exceeding those of more established economies.

For 2011, the GDP of Africa is estimated to be growing at 5.2 percent. It is significant that this rate is not based principally on the price of commodities but on growth in transportation, telecommunications, and manufacturing. In other words, engineering is playing a central role in the expansion.

Africa's consumer markets, supported by a growing middle class, are today as large as those of Russia and India. One key indicator of market growth is expansion of the telecommunications sector. According to a May 2011 report in *Harvard Business Review*, telecommunications companies in Africa have added more than 300 million subscribers to their networks since 2000. However, much remains to be accomplished; almost every traveler from the developed world to sub-Saharan Africa still remarks about limited and hard-to-operate Internet connections.

We are fully aware of the difficulties: poor infrastructure in many regions; the longtime debilitating effects of famine, disease, poverty, and war; deficiencies in many educational systems; political instability; and in some areas, political corruption. Yet we are also aware of increased stability in regions that were prone to wars and struggles for decades; of more responsible and consistent economic policies; and—perhaps the most important sign of soundness—increased entry into African markets by U.S., European, Indian, and Chinese companies.

Africa has been on my mind because expansion into the continent is an important challenge for IEEE

The time is now for IEEE to enter the African arena and make its mark—when growth gradients are strong and when IEEE and its members can do the most good by helping through education, training, capacity building, and expansion of infrastructure.

As the continent moves forward, the fields of interest of IEEE, including power and energy, telecommunications, networking, and computing, are bound to play major roles. Moreover, IEEE's ability to organize the technical community and provide training can serve a critical need. In many areas of Africa, we have the potential not only to become the link to other international hubs of engineering but also to help build local and national engineering communities.

Populations with which we can immediately connect are students and academics in Africa's many schools of engineering. We have a lot to offer—for example, access to our online library packages, student and instructor exchanges, sister student branches, and distance learning.

A first step in this direction was taken by our volunteers in Africa through IEEE's implementation of EPICS—Engineering Projects in Community Service. Started by Purdue University, this program launches teams of undergraduate university and high school students to design, build, and deploy real systems to solve engineering problems for local community-service and educational organizations.

Under the leadership of Saurabh Sinha of the IEEE South Africa Section and Kapil Dandekar of the IEEE Philadelphia Section, EPICS has now expanded into Namibia, Nigeria, South Africa, Uganda, Zambia, and Zimbabwe. Projects include building wind turbines generating electricity, mobile science labs, lightning-monitoring systems, and photovoltaic systems for charging mobile devices. EPICS is an excellent starting point for the new phase of IEEE's activities in Africa.

If you feel you can help or have an idea that can be of use, and especially if you are from Africa, please join us. We have several groups already at work on projects on the continent. Write to me at kam@ieee.org, and join the action. *Ke nako!*

Moshe Kam
IEEE President and CEO

the institute

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PRODUCTS AND SERVICES

Help With Getting Your Game On

BY KATHY KOWALENKO

YOU NEED A variety of skills to make it as a game developer, as described in "Making the Jump Into Games" (p. 5). And you can turn to IEEE's products and services for help in acquiring those skills.

CONTINUING EDUCATION

The Game Institute offers online professional training in video-game development. The school participates in the IEEE Continuing Education Providers Program, which includes certification courses, undergraduate and graduate courses, degree programs, webinars, and workshops—all at a discount of at least 10 percent for IEEE members. The institute teaches programming skills by having students build a game engine and supporting tools for designing and programming games. Students can learn C++ programming, 3-D graphics programming, game console design, artificial intelligence principles applied to games, and game mathematics and physics.
http://ieee-elearning.org/outreach

IEEE COMPUTER SOCIETY E-LEARNING CAMPUS

The campus offers two catalogs of material that can get you up to speed on gaming.

Dozens of topics related to game development are listed in the campus's course catalog. Topics include animation and multimedia, as well as programming and business skills like project management, sales, marketing, and finance for those interested in starting a game-development studio.

There's also the Safari Books Online catalog, a digital library containing technology and business books. The catalog includes *Beginning Blender: Open Source 3D Modeling, Animation, and Game Design*, which covers AI for developers, data structures and algorithms, and game programming with Python, Lua, and Ruby. Another book is the second edition of *Fundamentals of Game Design*, which presents material on concept development, gameplay design, core mechanics, user interfaces, and storytelling.
http://www.computer.org

IEEE COMMUNICATIONS SOCIETY WEBINARS

The society offers two programs:

The Game Theory for Multiple Access and Resource Allocation in Wireless Networks webinar is a crash course on techniques for theoretical game modeling of the multiple access problem in wireless systems. It covers noncooperative/cooperative models, static/dynamic models, and complete/incomplete information games and their application in developing multiple-access and resource-allocation methods.

The Coalitional Game Theory in Wireless Networks webinar provides an introduction to applying coalitional game theory to wireless and communication networks. It covers the concepts of cooperative game theory, its key properties, and fundamental components.
http://www.comsoc.org/webcasts

IEEE.TV VIDEOS

IEEE.tv includes several videos produced by *IEEE Spectrum* that cover different aspects of gaming:

- *Surgeons Got Game* shows how video games are making surgeons better at their jobs.
- *Your Digital Clone for Games, Videos, and More* explores how Big Stage, now part of Image Metrics facial animation software, lets you create and customize a 3-D avatar from simple snapshots of a face.
- *A Gaming Glove That's Fast Enough for Pros* features the Peregrine glove, which relies on conductive strips to replace numerous hot-key commands with simple hand gestures.
- *Video Game Workout* discusses how games can help children get exercise.
- *Surround Sound Headphones for Realistic Gaming* shows how an acoustics engineer uses waveguides to implement a true directional sound field within the privacy of headphones.

https://ieeetv.ieee.org

PUBLICATIONS

The IEEE Xplore digital library offers magazines and journals that cover game technologies. They include:

- *Computer*
- *IEEE Computer Graphics and Applications*
- *IEEE Intelligent Systems*
- *IEEE Multimedia*
- *IEEE Network*
- *IEEE Signal Processing Magazine*
- *IEEE Software*
- *IEEE Transactions on Computational Intelligence and AI in Games*
- *IEEE Transactions on Consumer Electronics*
- *IEEE Transactions on Intelligent Systems*
- *IEEE Transactions on Learning Technologies*
- *IEEE Transactions on Visualization and Computer Graphics*

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CONFERENCES: JANUARY–SEPTEMBER 2012

Several upcoming IEEE conferences cover topics related to gaming

IEEE International Conference on Digital Game and Intelligent Toy Enhanced Learning

TAKAMATSU, JAPAN; 27–30 MARCH

Focuses on all aspects of educational games, including robot and toy design, animation, virtual characters and storytelling, multiplayer game design, mobile and online games, and virtual role-playing games. Held in conjunction with the IEEE International Conference on Wireless, Mobile, and Ubiquitous Technologies in Education.

SPONSORS: IEEE Computer Society and IEEE Technical Committee on Learning Technology
VISIT: http://digitel2012.info

IEEE International Conference on Consumer Electronics

LAS VEGAS; 13–16 JANUARY

The theme of this year's conference is cloud computing. Other topics include 3-D video acquisition, processing, and display; personal health-care electronics; energy management devices for the home; securing digital content; and product safety related to consumer electronics.

SPONSOR: IEEE Consumer Electronics Society
VISIT: http://www.icce.org

IEEE SoutheastCon

ORLANDO, FLA.; 15–18 MARCH

The annual conference covers a wide range of topics including simulation and game development, technical education, embedded systems, robotics and computer vision, communications and networking, software engineering, data mining, and machine learning.
SPONSOR: IEEE Region 3
VISIT: http://www.southeastcon2012.org

International Conference on Consumer Electronics, Communications, and Networks

HUBEI, CHINA; 21–23 APRIL

Topics include game systems, interactive television, GPS navigation systems, home health-care devices, and audiovisual systems. Also on the agenda are RF and microwave devices, information theory and coding, optical communications, cognitive radio networks, computer architecture, and grid communications.
SPONSOR: IEEE Consumer Electronics Society
VISIT: http://www.ieee.org/conferences_events/conferences/conferencedetails/index.html?Conf_ID=19539

IEEE Conference on Computer Vision and Pattern Recognition

PROVIDENCE, R.I.; 18–20 JUNE

Presentations will explore computer vision for games, machine learning for movement analysis, object tracking, biometrics, embedded computer vision, and game theory. Other topics include software design and digital image processing.
SPONSOR: IEEE Computer Society
VISIT: http://www.cvpr2012.org

IEEE International Conference on Virtual Environments, Human-Computer Interfaces, and Measurement Systems

TIANJIN, CHINA; 19–21 SEPTEMBER

Covers virtual reality for games, human-machine interfaces, telerobotics, telemedicine, and environment sensing and monitoring technology.
SPONSOR: IEEE Instrumentation and Measurement Society
VISIT: http://vecims2012.ieee-ims.org

PROFILE

Roozbeh Jafari: Brain Game

Developing a game to rehabilitate soldiers

BY SUSAN KARLIN

SOME SAY VIDEO games are more than just fun—they can improve memory and motor skills. Others argue that they increase aggression. IEEE Member Roozbeh Jafari is among those who believe games can be used to improve people's lives. He is developing one to enhance the brain and motor functions of injured U.S. military personnel.

Jafari, a professor of electrical engineering at the University of Texas at Dallas, is researching wearable computers and body sensor networks for medical monitoring. As part of his research, he is codesigning a video game to help rehabilitate soldiers with brain injuries, as well as improve reaction times and hand-eye coordination.

The game is a joint effort between the university's Embedded Systems and Signal Processing Laboratory and its Center for Brain Health. The project began in August as part of a yearlong pilot program funded by the U.S. Defense Department. The program focuses on electroencephalogram (EEG) sensors and haptic devices for assessing human physical and mental performance. A 2008 study by the research and analysis company Rand Corp. estimated that some 20 percent of American troops injured in Iraq and Afghanistan suffer from traumatic brain injuries.

"We developed a system that can measure and enhance human performance," Jafari says. "The immediate applications are to rehabilitate soldiers suffering from mild traumatic brain injury [like a concussion] or determine the effectiveness of medication they're taking. But we're also looking into what is required for soldiers to make decisions and then make them faster. It's just a hypothesis, but we think we can train people to react more quickly to stimuli like enemy attacks and gunfire."

BRAIN ENGAGEMENT

Subjects play Jafari's game by first donning 3-D glasses and caps embedded with sensors that are linked to an EEG machine, which monitors electrical activity in the brain. Next, the participants manipulate a stylus to tap virtual green boxes as fast as possible when they appear on-screen. The stylus is programmed to assign different tactile characteristics to the boxes, such as weight and stickiness. Those sensations, although virtual, cause unexpected effects that can be measured in brain-wave changes.

"Every time a person experiences a surprise or recognition of an object—in this case, a green box suddenly appearing on-screen—the amplitude of brain waves in the frontal cortex jumps slightly, 300 milliseconds later, which the electrodes pick up," he says.

Jafari and his collaborators are interested in two aspects of that phenomenon. The first is the response time between the brain perceiving the green box and the electrical signal in the brain that commands the subject to tap it. The second is what occurs in the brain when the response times are longer or shorter than normal, something that can occur after a brain injury. The program is studying 25 people with normal brain activity to establish a baseline of normal reaction times.

Jafari's other research, which began in January as part of a two-year US $360 000 grant from the National Institutes of Health, involves developing a watch-size system for preventing the elderly from falling. The device monitors the upper torso's natural horizontal sway during walking and vibrates when the sway exceeds enough degrees to throw a person off balance. The vibration alerts patients to their imbalance to train them to walk properly again. It also keeps a record of sway for review by the patient's doctor.

At the conclusion of each research project, Jafari plans to publish his findings in an IEEE Transactions publication.

MEDICAL APPEAL

Growing up in Iran, Jafari anticipated following some kind of engineering career. "I've always been fascinated by engineering and physics," he says. "Electrical engineering is a good combination of applied physics and math. Embedded medical devices ultimately appealed to me the most because of the technological challenges involved in their design and development and their broader impact on society."

Embedded devices are trickier to develop than other electronic gadgets because they must be small enough to be wearable. "They're also highly constrained in computational resources—for example, 128 bytes of RAM versus gigabytes on personal computers—so developing the signal processing for these devices becomes extremely challenging," Jafari says. "And they require tiny batteries, so power optimization is very important."

Jafari earned a bachelor's degree in electrical engineering in 2000 from Sharif University of Technology, in Tehran. He earned a master's in electrical engineering from the State University of New York at Buffalo in 2002, as well as a master's in computer science in 2004 and a Ph.D. in computer science in 2006, both from the University of California at Los Angeles. He spent the next year earning a postdoctoral degree in electrical engineering and computer science from the University of California at Berkeley before landing his academic position in Dallas in 2007.

Jafari imagines far-reaching uses for his *Continued on page 19*

UNIVERSITY OF TEXAS AT DALLAS

PART-TIME PASSIONS

Breathing New Life Into Old Things

These engineers spend their extra time immersed in the artistry, craftsmanship, and restoration of electronics and furniture

BY SUSAN KARLIN

Gregory L. Charvat

JOB
Electrical engineer

HOMETOWN
Waltham, Mass.

AS A CHILD, Senior Member Gregory L. Charvat and his mom, an electrical engineer, would scour their neighborhood on garbage-collection day, looking for cast-off TV sets and radios, which they'd haul back to their basement to dismantle and restore. That was in the 1980s, when discarded sets contained vacuum tubes and other salvageable parts.

By high school, Charvat was not only restoring old electronics but also designing and repairing amateur radio equipment. His homemade radio telescope receiver placed second in the engineering category at the 1997 International Science and Engineering Fair, held in Louisville, Ky. His passion grew while taking electrical engineering courses at Michigan State University, in East Lansing. "Ultimately, this hobby launched my career," he says.

In grad school, Charvat parlayed his RF engineering experience and a course on electromagnetics into a project: building a small, high-resolution radar-imaging sensor in his basement. Some reps from MIT Lincoln Laboratory of Lexington, Mass., in town for a job fair, heard about his work through an MSU alum and stopped by his home to check it out. Shortly after, Charvat had a job offer from the lab, and he's now an electrical engineer there.

Charvat's hobby has made him a better troubleshooter at work, he says. "Every one of my projects is like solving a puzzle, and you can apply problem-solving skills to just about anything."

He spends about 18 hours a week fixing old radios he finds at antique radio swap meets and on eBay, as well as his friends' heirlooms. After an initial US $400 investment 15 years ago for workbench staples—an oscilloscope, RF signal generator, voltmeter, and a soldering iron—he now spends no more than $50 on parts for each project.

He finds the parts—such as vacuum tubes and capacitors, resistors, and transformers—at swap meets, by salvaging from other radios, and by buying from suppliers such as Antique Electronic Supply of Tempe, Ariz. For replacement parts, he opts for modern capacitors and resistors to gain reliability and safety and period-appropriate tubes.

"It takes about 80 hours to restore your average radio," he says. "It's very labor-intensive, and because my heart's not into doing this professionally, I often just give away the finished projects as gifts." In addition to restoring antique radios, since March he has been building a ham radio from scratch, using state-of-the-art parts in an old chassis.

He also fixes pocket watches, which is less time-consuming and complicated but offers him an aesthetic rarely seen in the 21st century. "A mechanical watch looks better inside than out," he says. "From the late 19th century to the start of World War II, American watches were the best in the world, from sapphire bearings to decorations on the movement [the internal mechanism]. There's a lot of action happening inside, and it feels like my restorations are breathing life back into them."

You can find photos of Charvat's restoration projects at http://www.mit.edu/~gr20603.

Bruce Wedlock

JOB
Director of MIT's evening school, retired

HOMETOWN
North Reading, Mass.

LIFE FELLOW Bruce Wedlock still has the wooden footstool and roll-top sewing cabinet he built as a teenager for his mother in 1948. And he is still enamored with woodworking, only now he infuses it with a little engineering and some master craftsmanship.

Wedlock has become an expert in building and finishing American Federal period furniture (1780–1820). He also builds other styles and has constructed a contemporary queen-size bed for his home, a pair of heirloom doll beds for his grandnieces, and an 18th-century Newport-style document chest. He hopes one of his latest pieces, a Federal period worktable [shown above], will be selected for display in a Connecticut Historical Society exhibit in Hartford.

"It takes time to build these things," he says. "People ask me to make them something, but when I tell them what I'd have to charge, they have a heart attack. My dentist asked me to make one of my doll beds for him. When I quoted him US $500, he stared at me. I said, 'That's only half what it would cost for a root canal!'" *Continued on page 19*

TOP: JOHN CIOFFI; BOTTOM: KATY PHILLIPS

Chandos A. Rypinski

MOBILE PHONE PIONEER
Member Grade: **LIFE FELLOW**
Age: **86**; *Died:* **27 JULY**

Chandos A. Rypinski was a radio engineer who designed mobile phone systems for several countries. A subsystem he developed was used on NASA's Pioneer space probes.

In 1948 he joined Northrop Aircraft (now Northrop Grumman) in Burbank, Calif., and then left for Collins Radio Corp. (now Rockwell Collins), which designed and produced equipment for shortwave and AM broadcast radios, also in Burbank. He left in 1958 to start his own firm, C.A. Rypinski Co., in Pasadena, Calif., to design and build radio components for aerospace applications.

The company developed an antenna duplexer, which made it possible to transmit voice or data without having to hit the "push to talk" button or saying "over" to conclude a transmission. The technology was used in NASA's first three Pioneer spacecraft and later in mobile phones.

In 1961 Rypinski became vice president of engineering at Secode Corp., a supplier of mobile phone systems. Nine years later he founded Rydax, a company that designed mobile phone systems.

Rypinski was a founding member of the IEEE 802.11 Wireless Standards Committee and was a member of the IEEE Antennas and Propagation, IEEE Communications, IEEE Computer, and IEEE Microwave Theory and Techniques societies.

Rypinski received a bachelor's degree in electrical engineering in 1948 from Caltech.

Tomomi Murakami

PIONEER OF COLOR TV
Member Grade: **LIFE SENIOR MEMBER**
Age: **89**; *Died:* **7 SEPTEMBER**

Tomomi Murakami helped develop the first mass-produced color television set.

In 1945 he began working for RCA Corp. in Camden, N.J., as an engineer on a research team that helped develop the first color TV.

In 1962 he joined RCA's Advanced Development Group, in Moorestown, N.J., where he helped develop technology for the U.S. government's Aegis shipborne missile-defense system. He retired in 1982 but continued as a consultant for RCA for 10 years.

Murakami received a bachelor's degree in electrical engineering in 1944 from Swarthmore College, in Pennsylvania. He earned master's and doctoral degrees, both in electrical engineering, from the University of Pennsylvania, in Philadelphia, in 1947 and 1970.

Wilson Greatbatch

CO-INVENTOR OF IMPLANTABLE PACEMAKER
Member Grade: **LIFE FELLOW**
Age: **92**; *Died:* **28 SEPTEMBER**

Wilson Greatbatch helped to develop the implantable pacemaker, a device that relies on electrical impulses to regulate and reproduce the human heart's correct rhythm.

In the early 1950s, Greatbatch was an assistant professor of electrical engineering at the University of Buffalo, in New York. In 1958 he collaborated with William Chardack, a surgeon at the Veterans Administration Hospital in Buffalo, to build the first internal pacemaker. Two years later the device was successfully implanted inside a 77-year-old man, who lived with it for 18 months.

Greatbatch founded Greatbatch Ltd., a company that manufactured his pacemakers, in 1970 in Clarence, N.Y. Two years later he invented a corrosion-free lithium battery that replaced the earlier zinc–mercuric oxide battery. That extended the pacemaker's longevity from about 2 years to more than 10 years.

In 1986 Greatbatch was inducted into the U.S. National Inventors Hall of Fame. He received the 1990 National Technology Medal from President George H. W. Bush. Greatbatch was a member of the IEEE Nuclear and Plasma Sciences Society.

He received a bachelor's degree in electrical engineering from Cornell University, in Ithaca, N.Y., and earned a master's degree in electrical engineering in 1957 from the University of Buffalo.

FROM TOP: ERICSSON; UNIVERSITY OF BUFFALO; PHILLY.COM.

DEADLINES AND REMINDERS

Nominations Needed

Nominations are being sought for 2013 IEEE medals, awards, recognitions, and prize papers. The deadline for nominations is 1 July 2012.

IEEE Medal of Honor
For an exceptional contribution or an extraordinary career in the IEEE fields of interest.
Sponsor: IEEE Foundation

IEEE Alexander Graham Bell Medal
For exceptional contributions to the advancement of communications sciences and engineering.
Sponsor: Alcatel-Lucent Bell Labs

IEEE Edison Medal
For a career of meritorious achievement in electrical science, electrical engineering, or the electrical arts.
Sponsor: Samsung Electronics Co., Ltd.

IEEE James H. Mulligan, Jr. Education Medal
For a career of outstanding contributions to education in the fields of interest of IEEE.
Sponsors: MathWorks, National Instruments Foundation, Pearson Education, Inc., and IEEE Life Members Committee

IEEE Medal for Environmental and Safety Technologies
For outstanding accomplishments in the application of technology in the fields of interest of IEEE that improve the environment and/or public safety.
Sponsor: Toyota Motor Corp.

IEEE Founders Medal
For outstanding contributions in the leadership, planning, and administration of affairs of great value to the electrical and electronics engineering profession.
Sponsor: IEEE Foundation

IEEE Richard W. Hamming Medal
For exceptional contributions to information sciences, systems, and technology.
Sponsor: Qualcomm, Inc.

IEEE Medal for Innovations in Healthcare Technology
For outstanding contributions and/or innovations in engineering within the fields of medicine, biology, and healthcare technology.
Sponsor: IEEE Engineering in Medicine and Biology Society

IEEE Jack S. Kilby Signal Processing Medal
For outstanding achievements in signal processing.
Sponsor: Texas Instruments, Inc.

IEEE Jun-Ichi Nishizawa Medal
For outstanding contributions to material and device science and technology, including practical application.
Sponsors: The Federation of Electric Power Companies, Japan

IEEE Robert N. Noyce Medal
For exceptional contributions to the microelectronics industry.
Sponsor: Intel Foundation

IEEE Dennis J. Picard Medal for Radar Technologies and Applications
For outstanding accomplishments in advancing the fields of radar technologies and their applications.
Sponsor: Raytheon Co.

IEEE Medal in Power Engineering
For outstanding contributions to the technology associated with the generation, transmission, distribution, application, and utilization of electric power for the betterment of society.
Sponsors: IEEE Industry Applications, Industrial Electronics, Power Electronics, and Power & Energy societies

IEEE Simon Ramo Medal
For exceptional achievement in systems engineering and systems science.
Sponsor: Northrop Grumman Corp.

IEEE John Von Neumann Medal
For outstanding achievements in computer-related science and technology.
Sponsor: IBM Corp.

IEEE/RSE Wolfson James Clerk Maxwell Award
For groundbreaking contributions that have had an exceptional impact on the development of electronics and electrical engineering or related fields.
Funded by Wolfson Microelectronics plc

IEEE Honorary Membership
For meritorious service to humanity in IEEE's designated fields of interest.
Sponsor: IEEE

IEEE CORPORATE RECOGNITIONS

IEEE Corporate Innovation Recognition
For outstanding and exemplary contributions by an industrial entity, governmental or academic organization, or other corporate body, which have resulted in major advancement of electrotechnology.
Sponsor: IEEE

IEEE Ernst Weber Engineering Leadership Recognition
For exceptional managerial leadership in the fields of interest to the IEEE.
Sponsor: IEEE

IEEE SERVICE AWARDS

IEEE Richard M. Emberson Award
For distinguished service to the development, viability, advancement, and pursuit of the technical objectives of the IEEE.
Sponsor: IEEE Technical Activities Board

IEEE Haraden Pratt Award
For outstanding service to the IEEE.
Sponsor: IEEE Foundation

IEEE PRIZE PAPER

IEEE W.R.G. Baker Award
For the most outstanding paper reporting original work published in any IEEE archival publication (such as transactions, journals, and letters), magazines, or proceedings.
Sponsors: IEEE Circuits and Systems, Communications, Control Systems, Information Theory, Power & Energy, Signal Processing, and Vehicular Technology societies

IEEE Donald G. Fink Award
For the outstanding survey, review, or tutorial paper in any of the IEEE transactions, journals, magazines, or proceedings.
Sponsor: IEEE Life Members Committee

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IEEE

PROFILE

Continued from page 16

research. The gaming device has already attracted inquiries from the professional sports industry, which could use it to enhance athletic performance. He also sees applications in education and for children suffering from attention-deficit disorders.

"Ubiquitous health monitoring can revolutionize the way the health-care industry functions, in both preventive and curative medicine," he says. "Damage caused by disease and other events can be minimized—even prevented—if detected, diagnosed, and treated early enough." ■

PART-TIME PASSIONS

Continued from page 17

After high school, Wedlock didn't seriously revisit his hobby until he took a 1992 woodworking class offered by MIT for retiring employees. Wedlock retired in 1996 from his job as director of MIT's Lowell Institute School, in Cambridge, Mass.

He followed up with furniture-making classes at the nearby Furniture Institute of Massachusetts and the North Bennet Street School.

He has since spent about $25 000 on power and hand tools and instruction ("still a lot cheaper than a yacht!" he says, laughing), plus $400 to $900 for wood and materials per project. Wedlock works up to 10 hours per week in his home shop, and he contributes articles to woodworking magazines.

"I'm known for applying engineering to woodworking," he says. "I work things out mathematically that others usually figure out by trial and error." For example, to make the 12 semicircles that decorate the vertical reeded legs of his Federal period worktable, he calculated the relationship between the diameter of the semicircles and the overall diameter of the leg. "People are always teasing me for working out formulas, but they're very useful," he says.

"Working on these pieces gives me a lot of satisfaction. When I'm working and concentrating, I'm not thinking or worrying about anything else." ■