AWESOME MINDS

VIDEO GAME CREATORS
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INTRODUCTION

LET’S GET THIS STARTED

The video games we play today come in many unique forms: as consoles for our TV, streaming online through our home computers, downloaded to portable devices like our phones and tablets, and even the fully immersive environment inside a virtual reality headset. But however we enter those worlds, video games all have one thing in common—the computer. People used computers to create all these games, and the devices we play them on are all computers of one kind or another.

The evolution of computers actually began long before that. It happened very slowly over a hundred years, starting in the year 1837. A man named Charles Babbage designed what he called the “Analytical Engine,” a machine that could do calculations automatically. In 1843, a woman named Ada Lovelace wrote an algorithm, a series of actions for the Analytical Engine to execute, making her the world’s first computer programmer. Babbage never finished a practical build of the Analytical Engine, and so Lovelace’s algorithm was never tested; nevertheless, what they created together were the ideas that became the modern computer more than a century later.

The advances that were made in modern computing—and video games—came at blinding speed. From the middle of the 20th century until today, computers and video games developed so fast that no one could ever predict how the new technology would look in 10 years. Computers in the 1950s were so big, they filled entire rooms, and computer technicians would

![Pong is one of the earliest arcade video games](image)
interact with walls of noisy processors grinding through their calculations. By the 1960s, technicians at labs like Xerox in Palo Alto, California, had made devices compact enough to be called “personal computers,” though they were still the size of a washing machine and you had to be a trained expert to operate one. Ten years after that, by the ’70s, computers became small enough that a person could put one on their desk at work and write a letter.

By the middle of the 1980s, more and more people had computers in their homes, with early black-and-white video games and interchangeable floppy disks (the icon we still use today to represent “save”) to store information. Not only that, there were dedicated video game consoles like the ones made by Atari and Nintendo; computers had become so common that special machines were manufactured and sold just for play. Modems and the World Wide Web began to enter our lives. By the ’90s, the home computer was a staple for every middle-class family, now equipped with email, web browsers, and games on CD-ROM featuring slick, colorful, highly rendered graphics. Video game consoles, too, brought us the high-powered, candy-colored games of Super Nintendo and Sega Genesis. And during the first decades of the 21st century, we’ve witnessed a technology boom in our own living rooms—graphics and sound as detailed and evocative as a movie, massive multiplayer virtual worlds, online streaming, and real-time interaction with other gamers.

The small computers we carry around nowadays—our phones and tablets—have more processing power in their tiny chips than those rooms full of computers at university labs did in the 1950s. Today we use computers to talk to friends all over the world, work, learn, shop, watch TV and movies...and of course, play video games. Let’s take a look at how we got here.
Brookhaven Lab held a public exhibition every year to demonstrate its latest developments. As the research facility prepared for its 1958 show, Higinbotham saw that Brookhaven’s brand-new model of computer could use its processing power to calculate wind resistance and simulate the trajectory of an object moving through the air. This could be useful for all kinds of practical purposes, like aircraft design and missile defense, but Higinbotham had a more fun idea for how to show off what the computer could do.

In a matter of hours, he designed a game called *Tennis for Two*, then sat down to build it with the help of a technician on staff, Robert Dvorak. They made custom handheld controllers out of aluminum, with a knob on the side. For the game’s display, they hooked their computer up to an oscilloscope, a device with a round screen that shows a digital wave representing electric voltage. Turning the knob, two players could “hit” a tennis ball—represented by a glowing blip—back and forth; each “swing” tweaked the voltage inside the oscilloscope so the “ball” seemed to sail across the screen.

There was a huge effort to drive technology forward during World War II, and as a result, the United States was suddenly full of young engineers and inventors working for the government after the war ended in 1945. Their efforts went into overdrive when, in 1957, Russia took the U.S. by surprise and launched the world’s first satellite, Sputnik. This kicked off the Space Race, and the U.S. rushed to develop computers, build rockets, and invent new and faster ways to communicate.

The government started the Advanced Research Projects Agency (ARPA) in 1958 to focus on these efforts; ARPA ended up creating the American space program (later spun off into NASA) and inventing the internet. Engineers at ARPA and at private government contractors would practice national defense by using computer simulators to shoot down imaginary missiles; these were early video games, meant only for top-secret government use and not for the public.

With a whole generation of new engineers, and an incentive to invent—winning the Space Race and keeping a leading edge in the Cold War against the Soviet Union—computers evolved very, very quickly.

*Tennis for Two* was a smash hit at the Brookhaven exhibition, drawing crowds of players and spectators. It was the first video game; other interactive computer programs
already existed—technology companies working for the government had created missile-defense simulators, and academic research labs had simple digital interfaces like tic-tac-toe and an electronic stylus to move a dot on-

screen through a maze, just to demonstrate how their machines were interactive—but *Tennis for Two* was meant for the public to play, and it was designed to entertain them. It wasn’t for sale in stores or available to play at arcades, but it would inspire countless other game designers after it...including a much more famous table tennis game. But more on that later.

Three years after the splash of *Tennis for Two*, the members of the Tech Model Railroad Club at the Massachusetts Institute of Technology (MIT)—a group involved with computers, technology, and the birth of hacker culture—were exploring the capabilities of the Programmed Data Processor-1, a sophisticated mainframe computer that had been donated to the school for young engineers to tinker with.

The massive machine cost over a hundred thousand dollars—roughly a hundred times more than your typical Apple laptop today. The PDP-1 could simulate forces such as gravity, and these young people, led by Steve Russell, dreamed up a way to incorporate this into a video game. They designed *Spacewar!*, a game pitting two spaceships—a needle and a wedge made of simple white lines on a black background—in a torpedo battle.

Mainframe computers aren’t the kind of machine you’d have at home. Today, they’re the computers used by big companies for all their large, automated calculation jobs—any kind of massive number crunching for data, statistics, and transactions. For example, when you order books from Amazon, rows of mainframe computers scan your order details, update the records of the warehouse inventory, and calculate the company’s profits.

But in the early 1960s, when MIT acquired the Programmed Data Processor-1, “mainframe” referred to any of the new kind of computer that housed its memory and its central processing unit (the computer’s “brain”) in its own stand-alone cabinet instead of running on several machines that filled a whole room.

The PDP-1 was built in 1959 by Digital Equipment Corporation and intended for use by government research labs. It was the first computer specifically designed to facilitate interactivity with its operator, lending itself easily for tinkering and innovation by clever and inventive users. It ended up becoming the first mainframe computer used for word processing, composing digital music…and video games.
Tennis for Two
Along with the world’s first video game, William Higinbotham gave us the world’s first video game controller in 1958—a handheld aluminum box with a circular knob on the side.

Spacewar!
Alan Kotok and Bob Saunders helped refine Spacewar! at MIT, and they improved on the game in 1962 by creating rudimentary gamepads with toggle switches—a forerunner of the arcade joystick.

Laser Clay Shooting System
The revolutionary toy light-beam gun invented by Gunpei Yokoi for Nintendo led the company to create the world’s first video game shooter in 1973.

Gran Trak 10
Atari put the player in the driver’s seat, equipping this 1974 video game cabinet with a steering wheel—the standard for arcade driving games to this day.

Atari 2600
Incorporating the intuitive joystick-and-button interface that had become popular at arcades, Atari’s pioneering controller for the 2600 console brought the joystick home in 1977.

Missile Command
The trackball controller invented for Missile Command in 1980 didn’t become a big part of arcade video games, but it was a forerunner of the mouse that would soon become a key accessory of home computers.

Game & Watch
Gunpei Yokoi flattened the joystick into a four-arrow directional pad for these portable Nintendo devices, starting with Donkey Kong in 1982, establishing the model it would use with the NES and other consoles for decades to come.

Nintendo 64
After more than 10 years and several consoles, Nintendo broke with its own tradition of the “D-pad” in 1996, adding a third handle with an optional joystick, plus a slot for a Rumble Pak—an add-on to make the controller rumble in a player’s hands.

Nintendo Wii
In 2006, after a decade of increasingly complex controllers, Nintendo changed the game again by adding a laser sensor for intuitive gameplay; players could use the cordless “Wiimote” like a classic Nintendo Entertainment System (NES) two-handed gamepad, swing it like a tennis racket, or point it at the screen like a gun.

Sony PlayStation
Exploring video game worlds took on a new dimension when the Sony PlayStation installed a second joystick in 1995, and Microsoft Xbox soon after, controlling a character’s viewpoint independent of their movement.
Nishikado also pioneered a new kind of video game cabinet; rather than the upright machines of before, he designed Space Invaders to be played on a table, with the screen laid horizontally in the top. Customers could sit and hunch over the table, staring down into it, with a place to put their pizza and soda while they played; game makers started calling this model of cabinet the “cocktail table.”

Eventually Space Invaders also became an upright cabinet, and for much of the ’80s, many of the classic video games would be built in both configurations, for standing or seated play. Taito sold 100,000 Space Invaders cabinets all over Japan, while in the United States, Bally Midway sold another 60,000. No other video game had ever come close.

**The Color Boom**

Just as Spacewar! inspired Bushnell’s Computer Space and the gameplay of Breakout gave Nishikado an idea for Space Invaders, each generation of new video games inspired the ones to follow. Space Invaders inspired a follow-up game a year later by Namco, another Japanese company. Galaxian was extremely similar to its inspiration—a spaceship on a black screen fending off an attack wave of creepy creatures—but it amped up the difficulty by moving faster, removing the shields that protected the player at the bottom of the screen, and having its aliens swoop down to attack. But more notably, Galaxian added something no video game had featured before: color. In an arcade full of black screens and white shapes, Galaxian jumped out. Its terrifying bad guys were flying space insects in green, purple, red, blue. Death meant the player’s spaceship going up in a beautiful, brilliant explosion of yellow and red. Galaxian, released in 1979—and its 1981 sequel, Galaga—kicked open the doors for all the flashing colors that would fill arcades in the 1980s.
PAC-MAN FEVER

It’s possible that no game was more iconic in its use of color than *Pac-Man*; but then, *Pac-Man* rightfully became a classic and legendary game because it pioneered a lot of firsts. It was the first game with a recognizable, charismatic lead character that players knew by name, instead of the nameless, never-seen heroes of *Space Invaders* and *Galaxian*. It also featured equally charming bad guys: the ghosts named Inky, Pinky, Blinky, and Clyde. No game before *Pac-Man* had ever had such catchy, memorable music and extremely unique sound effects—anyone who’s played *Pac-Man* at any length can hum the tune when a new level begins and knows the sound of the hero chomping his way through the maze; the alarm-like blare when eating a power pellet that makes your enemies turn blue; the bloop sound when you eat a ghost; and the heartbreaking but hilarious wail when *Pac-Man* dies. This was also the first game to launch a lucrative wave of tie-in merchandise like T-shirts, lunch boxes, stickers, and even a cartoon show—and this was by its creator’s design. It was also the first video game that successfully appealed to girls...also by design.

Toru Iwatani knew he wanted all of this when he set out to design a game for Namco. Because he knew that a face is a character’s most memorable feature, he didn’t just give his hero a face...he made his hero nothing but a face. When Iwatani’s eye landed on a pizza with a single slice taken out, he envisioned a little round guy, chomping nonstop (who, in the English version, was originally called *Puck-Man*). He also reasoned that making the bad guys bright and colorful with huge, cute eyes would make them likable and popular...even when they killed you (rew-rew-rew-rew–WAPWAP). And he knew that making the sounds of the game as memorable as the visuals would double its power at bringing players back again and again. *Pac-Man*’s gameplay was really easy to learn, and extremely tough to beat. All you had to do was get through the maze, eat all the dots, and avoid those deadly ghosts. With the addition of the occasional piece of fruit floating through the maze for bonus points, a shortcut on each side of the screen that zipped you magically back to the opposite side, and power pellets to turn the tables and make *Pac-Man* deadly to the ghosts instead, the game’s simple premise allowed for incredibly complex strategy.
Iwatani wanted his game to have broad appeal because he foresaw its potential for sales—not just the sale of addictive gameplay in exchange for quarters, but as a vehicle for merchandise. Even before pitching the game to his bosses at Namco, Iwatani personally mocked up some homemade T-shirts and sewed his own stuffed toys to give the company an idea of the possibilities. But Pac-Man’s success went beyond what even Iwatani had dreamed of; the game did successfully expand its appeal to girls and women, and the customer base for video games practically doubled. Arcades, which used to be filled mainly with boys, saw girls start to stream through the doors, and suddenly arcades became a place where couples could go on dates. Pac-Man, just by itself, generated so much business for arcades that it caused more of them to go into business all across the United States. It spawned multiple re-editions, sequels, and spin-offs, including *Ms. Pac-Man*, *Jr. Pac-Man*, *Super Pac-Man*, *Pac & Pal*, and *Pac-Man & Chomp-Chomp* and it remains a hugely popular and beloved force of pop culture to this day.

Ironically, when *Pac-Man* made its debut for arcade industry professionals at a trade show in Chicago in October of 1980, it didn’t make a splash. The game’s U.S. distributor, Bally Midway—the same company that passed on *Pong*—didn’t think a maze game would be very popular and didn’t have very high expectations for the deal. But it had already agreed to distribute *Pac-Man*, and the game’s monstrous success would come as a huge and positive surprise.

Another game, *Defender*, debuted at the same show; it didn’t make a splash, either, but it would also go on to defy expectations and become a huge hit.

Eugene Jarvis wanted to design pinball games, but by the time he started working, those were on their way out. He switched to video games reluctantly, intent on making a game as exciting and overwhelming as the chaotic action of a pinball machine. In the process, he also identified something other games were missing, and he built his game around it. Other games were