Evolution of Game Console Technology

VIDEO GAMES have come a long way since the early days. In 1967, the first console was developed, and consoles have progressed in the years that have followed. With the advancement of speed, graphics, and interactivity, modern consoles are advanced compared to those developed in the beginning. Video game companies continue to develop more superior consoles and controllers to give us the quality of home gaming systems we have today.

Objective:

Describe and differentiate the evolution of game consoles, and compare and contrast modern vs. older game systems.

Key Terms:

Atari
Blu-ray
Brown Box
CPU
Odyssey
Pong
Ralph Baer
ROM
VES
Xbox

Game Console Technology

Users of today's game consoles are often unaware of the humble beginnings of the industry and how technology has advanced. This unit takes a look at how game console technology has changed.

EVOLUTION OF VIDEO GAME CONSOLES

Game consoles have evolved over the years from the early Brown Box to the consoles on the market today.

Brown Box

In 1967, the first console was called the Brown Box. Television engineer **Ralph Baer** was the individual who conceived the idea of an interactive television (game console) while building a television set from scratch. In 1966, while he was the chief engineer and manager of the Equipment Design Division at Sanders Associates, Baer created a simple two-player video game that could be displayed on a standard television set. It was called "Chase," and two dots chased each other around the screen. Baer continued development on hardware and on games.

In 1967, he created the final **Brown Box**, which was the first game console prototype that had two controllers, a light gun, and 16 switches on the console that selected the game to be played. Baer approached several U.S. television manufacturers and eventually signed with Magnavox in late 1969. Magnavox made the following alterations to the Brown Box: Plug-in circuits were used instead of switches to change the games; the color graphics capabilities were removed in favor of color overlays to reduce manufacturing costs; and it was released in May 1972 as the Magnavox Odyssey.

1972 Magnavox Odyssey

Magnavox released the first commercially available game console: the Magnavox **Odyssey**. The Odyssey was built using a combination of analog (for the output, game control) and digital circuitry. It was not a large success because of restrictive marketing. However, other companies with similar products (including Atari) had to pay a licensing fee for some time. The Magnavox Odyssey lacked sound and was powered by batteries. The system did not last for long because of poor marketing. It was improved later as Odyssey 100, 200, 300, 400, and 500.

1975 Pong

In 1971, Nolan Bushnell saw a demonstration of the Magnavox Odyssey. In 1972, Nolan formed **Atari** (an early video game company) with engineer Al Alcorn to produce an arcade version of Odyssey's ping-pong game: **Pong**. Pong became the company's first big hit. The display consisted of black-and-white graphics and was hooked to an existing television set. Pong's unique feature was the use of a single chip that produced graphics and sound when the paddle struck the ball. Home video games achieved widespread popularity with the release of a home version of Pong during the 1975 holiday season. Its success sparked hundreds of clones, including the Coleco Telstar, which went on to be a success in its own right, with more than a dozen models. In 1976, Atari released Super Pong, which had four versions.

1976 Fairchild Video Entertainment System (VES)

The Fairchild **VES** was the world's first CPU-based video game console, introducing the cartridge-based game code storage format. A central processing unit (**CPU**) is the hardware within a computer system that carries out the instructions of a computer program by performing the basic mathematical, logical, and input/output operations of the system. Other consoles had used cartridges, but they had no data and served a function similar to flipping switches.

The VES used a programmable microprocessor, and the cartridges just required a single read-only memory (**ROM**) chip.

ROM is a class of storage medium used in computers and other electronic devices to store the processor's instructions. With games now consisting of microprocessor-based codes, these games were burned onto ROM chips mounted inside plastic cartridge casings that could be plugged into slots on the console. When the cartridges were plugged in, the general purpose microprocessors in the consoles read the cartridge memory and ran the stored program. Rather than being confined to a small selection of games included in the box, consumers could purchase vast libraries of game cartridges.

Other game console manufacturers (e.g., RCA and Atari) introduced their own cartridge-based consoles. When Atari released its VCS the next year, Fairchild quickly re-named the system to the Fairchild Channel F.

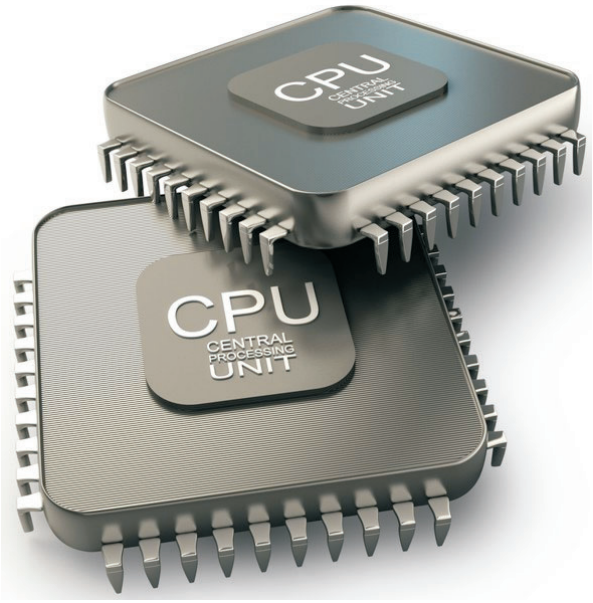

FIGURE 1. A central processing unit (CPU) is the hardware within a computer system that carries out the instructions of a computer program by performing the basic mathematical, logical, and input/output operations of the system.

1977 Atari 2600

In 1976, Bushnell sold Atari to Warner Communications for 28 million dollars. Warner backed up further development of the game systems. In 1977, Atari released its CPU-based console: the Video Computer System (VCS). Later it was called the Atari 2600. Nine games were designed and released for the holiday season. It would quickly become the most popular of all the early consoles. Some of the more popular titles included *Space Invaders, Missile Command,* and *Combat.* The console and its games are popular with collectors because of the significant impact they had on video game and consumer electronics history. They also have nostalgic value for many people.

FIGURE 2. This is a CPU-based console that was popular during the late 1970s.

1980 Mattel Intellivision

Toy-maker Mattel released Intellivision as the first real challenge to the Atari 2600. More than 3 million Intellivision units were sold, and a total of 125 games were released for the console. Advertising campaigns demonstrated the superiority of its graphics and sound to those of the Atari 2600 using side-by-side game comparisons. Intellivision was the first 16-bit game console. Atari and other systems used an 8-bit processor. It is ranked as the 14th best overall game system by *IGN* magazine.

1983 Nintendo Famicom/NES

In 1983, Nintendo came up with the Famicom (short for "family computer") or NES series of games, which brought about a change in the video game console market. The NES series featured full-colored, high resolution, and longer games with detailed graphics. The game was bundled with a plastic robot and a light beam gun. The system used a handheld control with two red buttons and arrows to select games. Games (e.g., *Super Mario Bros*.) were designed to work with this set-up. Retailers were skeptical about marketing a new game system after the video game crash of 1983. However, Nintendo quickly found massive success with games such as *Super Mario Bros*. and *Donkey Kong*, heralding the return of video game consoles. In 1985, Famicom was re-launched as the Nintendo NES in the United States. It quickly became one of the best-selling consoles in video game history, with more than 62 million units sold.

1989 Sega Genesis

Sega Genesis was a fourth-generation video game console developed and produced by Sega. It was originally released in Japan in 1988 as the Mega Drive, but it was released in North America in 1989 as Sega Genesis. Sega Genesis was vastly superior to the Nintendo NES in graphics and sound quality. It used a 16/32-bit processor and had the first use of stereo sound in a gaming system. Sega Genesis became successful because of its games, including *Sonic the Hedgehog,* which was used to compete with Nintendo's Mario game series. When the arcade game *Mortal Kombat* went on sale for home release on the Mega Drive/Genesis and Super Nintendo Entertainment System, Nintendo decided to censor the game's gore, but Sega kept the content in the game, hoping to position its console as the more "mature" product. Sega's gamble paid off, and its version of *Mortal Kombat* received generally higher and more favorable reviews in the gaming press. Sega was first to franchise the popular Madden series.

1991 Nintendo SNES

SNES was Nintendo's answer to the Genesis 16-bit system. Throughout the early 1990s, Nintendo and Sega battled for game system market share. By the mid-1990s, SNES surpassed Genesis to become the top-selling 16-bit game system. The success of the SNES can be attributed to a wide range of games (e.g., *Chrono Trigger, Earthbound, Final Fantasy II* and *III, Secret of Mana, Street Fighter,* and *Mortal Kombat*).

1995 Sony PlayStation

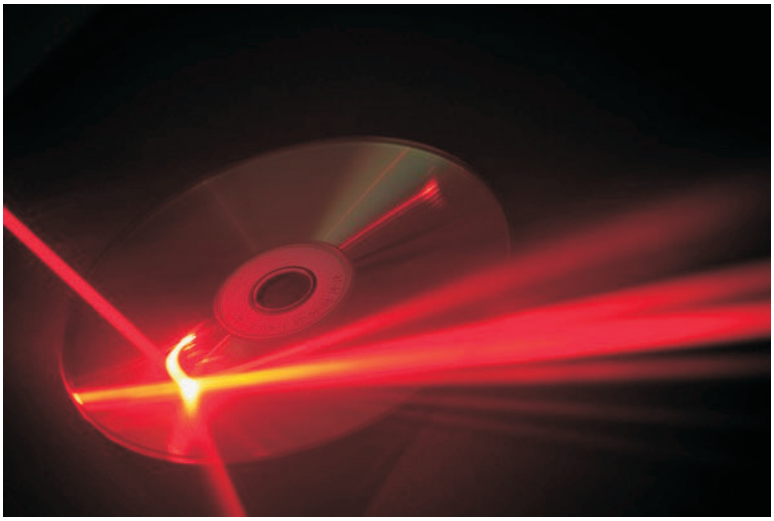

FIGURE 3. PlayStation ushered in the use of CD-ROM technology.

PlayStation became the most popular console of the 32-bit era. This allowed the system to emphasize three-dimensional graphics for the first time over 16-bit, 2D games. It ushered in the use of CD-ROM technology. The initial plans were to make this system as an add-on to Nintendo's SNES, but the deal fell through. Sony marketed the technology as the PlayStation. This allowed for games to be priced less than those using game cartridges. A few of the many console favorites are *Final Fantasy VII, Tekken 3, Twisted Metal 2, Castlevania Symphony of the Night, Resident Evil 2, Metal Gear Solid,* and *Suikoden II.*

1996 Nintendo 64

The 1996 Nintendo 64 used a 64-bit processor. It was the last mass-marketed system to use cartridges. Although they were more expensive, the cartridges loaded faster than the PlayStation CDs and thus lacked the load screens. The cartridges eliminated the need for memory cards. The top games for the system were *Zelda Ocarina of Time, Goldeneye, Rogue Squadron, Mario 64,* and *Smash Bros.*

2000 PlayStation 2

The 2000 PlayStation 2 was the first 128-bit system. It featured backwards compatibility. Therefore, you could play older PlayStation 32-bit games on PS2. It played CDs and DVDs. DVDs allowed for longer game times and more realistic graphics. It was the most popular game console of all time, selling more than 130 million units. With more than 1,900 titles available, popular games still include *Grand Theft Auto, Metal Gear,* and *Final Fantasy.*

2001 Nintendo GameCube

Like PlayStation, the 2001 Nintendo GameCube used a 128-bit processor. It was the first Nintendo console to take advantage of optical disc-based media. The GameCube was the first to use a unique storage medium, the GameCube Optical Disc, which was a proprietary format based on Matsushita's optical-disc technology. The discs are approximately 8 centimeters ($3^1/_8$ inches) in diameter, which is considerably smaller than the 12 centimeter CDs or DVDs used in competitors' consoles. The GameCube showcased several sequels to popular Nintendo franchises as well as some new ones. Some of the more popular titles are *Metroid Prime* 1 & 2, *Zelda Twilight Princes, Pikmin* 1 & 2, and *Starfox Assault.*

2001 Xbox

Microsoft entered the game console business with **Xbox**. It competed with Sony's PlayStation 2, Sega's Dreamcast, and Nintendo's GameCube. The integrated Xbox Live service allowed players to compete online over a service that supported dozens of games on a Microsoft hosted server. This was a pioneering business model still used today by all console manufacturers. Popular games available on Xbox are *Fable, Forza, Bioware,* and *Halo.*

2005 Xbox 360

Xbox 360 is the second video game console produced by Microsoft. It was developed in cooperation with IBM and ATI Graphics. It includes the integrated Xbox Live service, which allows players to compete online and download content (e.g., arcade games, game demos, trailers, TV shows, and movies). Xbox 360 is the successor to Xbox. It competes with PlayStation 3 by Sony and Wii by Nintendo as part of the seventh generation of video game consoles. As a result of its early launch, Xbox 360 had a one-year lead on its competitors: Sony's PlayStation 3 and Nintendo's Wii. The console's best-selling games include *Call of Duty 2, Ghost Recon Advanced Warfighter, The Elder Scrolls IV: Oblivion, Dead or Alive 4, Saints Row, Gears of War,* and *Halo.*

2006 Nintendo Wii

Wii is spelled with two "i"s to imply an image of players gathering as well as to represent the console's controllers. The Wii remote is a one-handed controller that uses a combination of accelerators and infrared detection to sense its position in 3D space. The Wii remote allows users to control the game using physical gestures as well as traditional button presses. The most important device is the Nunchuk unit, which features an accelerator and a traditional analog stick with two trigger buttons. The Wii is Nintendo's fifth home console and the successor of the Nintendo GameCube, with most models being fully backwardly compatible with all GameCube games and most accessories.

2006 PlayStation 3 (PS3)

PS3 is the third home video game console produced by Sony Computer Entertainment. It is the successor to PlayStation 2 as part of the PlayStation series. PlayStation 3 competes with Microsoft's Xbox 360 and Nintendo's Wii as part of the seventh generation of video game consoles. The main console features are its unified online gaming service, the PlayStation Network, its multimedia capabilities, connectivity with the PlayStation Portable, and its use of the Blu-ray disc as its primary storage medium. The disc drive is a 2x speed Blu-ray disc drive for games, Blu-ray movies, DVDs, CDs, and other optical media. **Blu-ray** is an optical disc format similar to CDs and DVDs developed for recording and playing back high-definition (HD) video and for storing large amounts of data. While a CD can hold 700 MB of data and a basic DVD can hold 4.7 GB of data, a single Blu-ray disc can hold up to 25 GB of data. PlayStation 3 is available with hard drive configurations of 20 GB, 40 GB, 60 GB, 80 GB, 120 GB, 160 GB,

250 GB, and 320 GB. Popular games are *Gran Turismo, God of War, Metal Gear Solid 4, Final Fantasy XIII,* and *Tekken 6.*

2012 and On

Microsoft Kinect is a webcam-style add-on peripheral for the Xbox 360 console that enables users to control and interact with the Xbox 360 without the need to touch a game controller. Interaction is through a natural user interface by using gestures and spoken commands. The project is aimed at broadening the Xbox 360 audience beyond its typical gamer base.

Wii U has a controller (which represents a touchpad) that features a touch screen more than 6 inches wide and contains a built-in microphone, speakers, gyroscope, accelerator, rumble, and camera. The controller allows a player to continue a gaming session by displaying the game even when the television is off. The system will be fully backwards compatible with Wii.

PlayStation 3 is a motion-sensing game controller platform for the PlayStation 3 (PS3) video game console. Based on a handheld motion controller wand, PlayStation Move uses the PlayStation Eye camera to track the wand's position, and it uses inertial sensors in the wand to detect its motion. The Move competes with the Wii Remote Plus and Kinect motion controllers for the Wii and Xbox 360 home consoles, respectively.

EVALUATING GAME SYSTEMS

The comparisons between modern and older game systems can be striking.

Modern Game Systems

- The hardware has high-speed, 128-bit CPU processors. Some modern systems have integrated hard drives for saving and storing games.
- The graphics have high-quality graphics and 3D capability. They have full color and high definition. Some systems are now capable of 1080 pixels per inch.

UNDER INVESTIGATION...

LAB CONNECTION: Game Console Usage

Prepare a short survey to ask your classmates. The survey should include questions such as: What type of game console do you own? If you like more than one, please list them all. If you like more than one, which would you consider your favorite, and why? How many games do you own? Are you happy with the console you own? If not, why? Would you like to purchase a new game console? Come up with other questions that may be of interest to you in the survey. Do not make the survey too long, or students will not want to participate. Have 25 to 30 students complete the survey. Use graphs to display your information in a presentation software program. Discuss your findings with the class in a 3- to 5-minute presentation.

- The interface/controls in modern gamepads have multiple input buttons and joysticks. Newer technologies (e.g., Wii and Kinect) react to player movements.
- The visuals are highly realistic for characters and backgrounds. Backgrounds move or change as players move through scenery.
- They have stereo or surround sound capabilities. Also, they have high-quality sound effects to match movements, action, etc.
- They use CD-ROM, DVD, or Blu-ray technology as their media format to provide higher quality graphics and longer game times. Many systems now allow for online gaming experiences through Internet connection.
- Currently, three manufacturers dominate the market: Nintendo, Sony, and Microsoft. Nintendo is the creator of Wii and Nintendo DS handheld series. Sony is the creator of PlayStation and the PSP handheld series. Microsoft is the creator of the Xbox series.

Older Game Systems

- In early games, hardware used 8-bit processors. There was no on-game storage capability.
- Early games had black and white images, but no color existed for graphics. Fairchild was the first system to offer color through connection to a TV.
- For interface/controls, early controllers used joysticks that allowed for eight directional movements. Controllers (e.g., the Mattel Intellivision) used a combination joystick and keypad. Nintendo introduced the basis for the modern controller with the "D-Pad" controller. It used a directional arrow key and two function buttons.
- They had simple, block-shaped pixels for characters and backgrounds as visuals. Some backgrounds were just simple fields of color.

FIGURE 4. The use of a directional arrow key dates back to older game systems.

- The early Magnavox system had no sound. It was not until the advent of Fairchild Channel F that sounds were an element. By the early 1980s, sound progressed to multi-channels, so it was capable of playing music tracks and sound effects simultaneously. Early systems used just sound effects, so there was no background sound.
- The media format on early systems (e.g., Magnavox and early Atari) had games preloaded on the console. There was no ability to add new games. Fairchild and Atari introduced cartridges that had read-only memory (ROM), which allowed for games to store more information and to load faster. Cartridges became the preferred method until the middle 1990s when CD-ROMS became available.
- At one time, there were more than 30 manufacturers of video game consoles. A partial list of early manufacturers includes Magnavox, Atari, Coleco, RCA, Mattel, Sega, Commo-

dore, Panasonic, Nintendo, Bandai, and NEC. Most have ceased operations because of lack of third-party development for games. Now Sega exists as a game software company.

Summary:

The first console was called the Brown Box and was conceived while Ralph Baer was developing a television set from scratch. The first commercially available game console was released by Magnavox in 1972 and was called Odyssey. Atari, Mattel, Nintendo, Sega, Sony, and Microsoft have followed in the making of video game consoles. Modern games have developed through the years with faster speed, higher quality graphics, more interactivity, and high-quality sound.

Checking Your Knowledge:

1. What company exists as a game software company now?
2. What does CPU stand for?
3. What does ROM stand for?
4. Who were the two men to develop Atari?
5. Which company used the first cartridges?

Expanding Your Knowledge:

Write a three- to five-page biography on the life of Ralph Baer. Discuss how Baer led the way in the evolution of video game consoles. What other accomplishments did Baer achieve in his lifetime? End the report with a list of other developers who led the way to the game developments of today with a short description of what they accomplished.

Web Links:

Evolution of Home Video Game Consoles
http://www.hongkiat.com/blog/evolution-of-home-video-game-consoles-1967-2011/

History of Video Games
https://www.princeton.edu/~achaney/tmve/wiki100k/docs/History_of_video_games.html

How Video Game Systems Work
http://electronics.howstuffworks.com/video-game2.htm