# History of the Game Controller

by Dark Watcher

**Gamepads**, **Joysticks**, **Joy Pad**, etc... They go by many names and came in various styles and sizes, but controllers have always been the interface between the gamer and the game. They are the input devices that accept gamer movements and manipulations, and convert it into data that the console can interpret. Just like the consoles that they belong to, game controllers have seen numerous evolutions.

Early 1970's (particularly **Pong** units), the controllers were knob style and were built into the console deck. You were forced to play at the machine. The knobs could be turned left or right, and were interpreted by the consoles as onscreen up / down movement (or left / right movement in some games).

They soon created controllers that you could be held in your hand, but the controller cords were hard wired into the console, and the cord length was limited. The hard wired cords also forced gamers to have to turn in entire consoles for repair if a controller became defective. Knobs were still popular until the eventual arrival of the **Joystick**.

Use the following links for a quick jump to the controller era of your choice:

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## Early Controllers

**Joysticks** allowed 8 directional digital movements (up/down/left/right/angles) with a single action button. They were bulky with a heavy base, and a long protruding handle / stick that could be gripped in a fist. The **Atari 2600** was one of the first machines to popularize joysticks. It was also one of the first controllers that allowed disconnection from the console. This allowed gamers the ability to replace defective controllers. This also gave **Atari 2600** the ability to use various other controllers such as paddles and balls. These paddles were some of the early developments of analog control. Instead of movement translated into digital signals, the analog controllers used potentiometers. These potentiometers could detect the speed of gamer paddle manipulations, and translate it to an equivalent onscreen movement. The paddles were similar to the knobs, and only detected left / right or up / down movement. The ball controllers could recognize 4 directional analog movements. These controllers were the ideal choice for **Pong** / **Breakout** styled games.

The **Atari 2600** joysticks were not ergonomically friendly, and put some strain on the wrist. Developers also noticed that the sticks would quickly become defective because of the grip and force exerted by excited gamers (good thing that they could be replaced) This contributed to an early design change adopted by later consoles. The joystick would be changed to have a smaller handle that could be manipulated by either the thumb or two fingers. This reduced the amount of force exerted by gamers. One of the first consoles to adopt this redesign was the **Bally Astrocade**. The **Astrocade** controller was quite innovative for its time. It resembled the pistol grip of a gun, and even featured a trigger-like action button. The small joystick rested on the top of the pistol grip. The joystick also featured a twistable knob that could be used for paddle games. Essentially the **Bally Astrocade** controller was both analog and digital. While other controllers were adopting the use of smaller joysticks, **Mattel Intellivision** took the opportunity to shake up controller evolution even further. Rather then using a joystick, **Intellivision** used a metallic "circular direction disk" that could be manipulated by the thumb. This "circular direction disk" used digital signals for recognition of up to 16 directions (8 more then standard digital controllers). **Mattel** would also add 4 "side mounted" action buttons. The upper side buttons shared the same function, but this allowed flexibility for both left and right handed gamers. Some consoles such as the **Bally Astrocade** and the **RCA Studio 2** featured keypads mounted on the console. The functions of these keypads could be used for programming, or to effect game play. The **Intellivision** incorporated the keypad into the controller. The keypad could be used to select different aspects of the game such as difficulty and level selection (Start / Reset /etc). This freed gamers from the hassle of having to get up to start, select levels, or reset from the console. Some games allowed the keypad to be used as part of game play, and overlays would be used to identify the game functions of each button. The expanded features of the **Intellivision** controller did away with the need for other miscellaneous controllers (the controllers were not removable in early models). Some loved it, and some hated it, but overall **Mattel** sparked a change in the evolution of controllers. Quite a few consoles such as **Colecovision** borrowed many elements from the **Intellivision** design.

It was the 1980's, and **Atari** had found a fierce competitor in the console market. The rival console known as **Intellivision** possessed controllers that allowed for 16 directions of movement (and other features). **Atari** decided to out do their competition with the creation of an analog joystick with 360 degree directional movement. The same analog potentiometer technology previously used in paddles would find its way into the **Atari 5200** controllers. The **Atari 5200** controllers would also feature a built in keypad, and sport 2 action buttons. **Atari** would also feature what would soon be commonly known as a "Pause" button (the **Intellivision** had a similar "pause game play" feature by pressing "1" and "9" on the keypad). However, the same innovative step towards analog control proved to be a handicap for **Atari 5200** gamers. The analog control could not "self center". In other words, the controller did not recognize a neutral position, and this translated to you game play where you can stay in one place (your always

Consoles such as **Vectrex** and **Emerson Arcadia** (and its many clones) would implement "self-centering" and create analog joysticks that functioned correctly. The **Vectrex** would implement 4 action buttons, while the **Arcadia 2001** would borrow the keypad / side-button layout from the **Atari 5200**. **Emerson** would also borrow the "circular direction disk" control from the **Intellivision**. In order to satisfy those who were familiar with joysticks (and not a thumb manipulated disk), **Emerson Arcadia** controllers had a screw hole in the center of the circular disk that allowed the addition of an optional joystick.

## Controllers of the 80's & 90's

During the early 1980's, a Japanese inventor named **Gunpei Yokoi** would create a controller interface that would later become known as a **D-Pad** (Digital-Pad). This **D-Pad** used a "cross-shaped" directional digital control interface that could be manipulated with the thumb (similar to **Intellivision's** "circular disk"). **Nintendo** truly popularized the **D-Pad** in 1984/85 with the release of the **Nintendo Famicom (NES)**. The pad allowed for 8 directional movements, and featured 2 action buttons. Two smaller buttons were incorporated to start, pause, and select game play options. The pads were designed to be small enough to easily fit in a child's hands. **Gunpei Yokoi**'s invention would revolutionize game controllers once again. Console manufacturers would soon favor the use of **JoyPads** over the use of **Joysticks**.

Controllers soon started to develop more unique functions such as Slow Motion (Manipulating the pause / start button), and rapid fire (holding a button would simulate rapid button presses). Some of these had to be purchased as separate accessories, but some consoles like the **NEC Turbografx** had the features built in. Developers also began to experiment with other forms of game control. Nintendo for example used motion sensing technology (**Power Glove** / **U-Force**), but many did not catch on or had limited use. Controller cords also became longer, and more flexible.

Between 1989 and 1990, **JoyPads** continued to borrow from the **D-Pad** concept. **Sega** introduced a 3rd action button with its **Sega Genesis** pad, and the controller was rounded off to ergonomically feel more comfortable in the hands of gamers. An arcade fighter craze soon spurred the development of **Sega**'s 6 button (3 top / 3 bottom) variations that were sold separately (the fighter craze also seemed to bring back the popularity of **Joysticks** which are still prominently used in arcades. Gamers wanted to recreate the "arcade feel" of many "arcade to console" ports). **Nintendo** returned fire with their own 6 button standard **SuperNES** controller that strategically placed 2 action buttons on what would later be called "shoulder buttons". The **SuperNES** pad was also rounded, and maintained a smaller size for children's hands. The appearance was almost dog biscuit shaped, and it allowed the sides of the controller to be easily "cupped" by the hands. The "shoulder" buttons could easily be pressed by both index fingers. The other 4 buttons were placed angled, and mimicked the "cross-shaped" style of the directional pad. The idea was to make the buttons easily accessible with the thumbs.

The big players (**Sega** / **Nintendo**) seemed to bring about even more new innovations or led the way in overall controller designs. Many other consoles adopted similar controller layouts that were brought about by the **Sega** / **Nintendo** rivalry.

The 32-bit era had **Sega** debut their **Saturn** controller. It featured the same 6 button (3 top / 3 bottom) variation of their Genesis pad, but was slightly smaller to ergonomically suit gamers with smaller hands (an adoption of **Nintendo**'s policy). This time it was **Sony** who served as the as the developing rival. The **Sony Playstation** controller design used many elements from Nintendo's **SuperNES** pad. It featured the same "cross-shaped" 4 button layout, and took an additional step of adding 4 shoulder buttons (for a total of 8 action buttons without counting the "Start / Select" buttons). The design was also extremely friendly ergonomically, and took the concept of "cupping" the controller another step forward. The shape allowed the controller to not only be "cupped", but also gripped comfortably with the hands.

Oddly enough, **Atari** decided to mix the designs of **D-Pad** controllers, and that of their numerical style classic controllers. The result became the controller of the **Atari Jaguar**.

Not to be outdone, **Nintendo** soon returned with their **N64** controller. This time **Nintendo** placed 6 buttons (4 "cross-shaped" style with an additional 2 buttons immediately to the left), 2 shoulder buttons, and a button at the bottom that can be used like a gun trigger (similar to the trigger button from **Bally's Astrocade**). The controller featured both a digital directional pad, and an analog joystick. The analog joystick not only allowed for 360 degree movement, but a characters movement could either crawl / walk / run based on the amount of pressure that was placed on a particular direction. The mini joystick could be either manipulated with two fingers, or be manipulated with the thumb like a digital pad. The design was almost trident like, and allowed for different game play styles and grips. The N64 pad took an additional step by featuring a slot to upgrade the features of the console. 2 features that could be added was a "rumble pack" that caused the controller to shake during certain game play events (also called **Force-Feedback**), and also a memory pack that allowed you to take your game saves from your console to another N64 owner's console (portable game saves).

**Sony** would later decide to add similar features to their controllers. The **Dual Shock Playstation** controller debuted in April of 1998. The pad design was similar to the original, but featured two analog joysticks in the center. The **Dual Shock** also had built in rumble capability. An additional button was added to allow the gamer to turn analog mode on or off. The joysticks could be either manipulated with two fingers like most joysticks, or be manipulated with the thumb like a digital pad (since the joystick featured a rough rubber top). The joysticks could also be pushed down to serve as additional buttons (bringing the amount of action buttons to 10).

## The Controllers of 2000

Ah..the 128-bit era...

With their **Dreamcast** console, **Sega** seemed to borrow the upgrade slot feature of the **N64** pad. The slot could also be used for save games (**VMU**) or a rumble pack. Each controller had two upgrade slots. It featured the usual 4 button "cross-shaped" layout, but elected to use 2 trigger-like buttons instead of shoulder buttons. It also possessed both a digital pad and analog joystick, but placed them on the same side of the controller. A new feature added by **Sega** was a small a small screen display for use with the **Sega VMU**. The small screen could be used as a private screen, and could show small graphics and statistics. The controller was large, but still featured the "grips" that had become common after the **Playstation** controller.

**Shock** for **Playstation**, but featured pressure sensitive analog buttons. Game play could now be based on how hard you pressed a button (for example an onscreen character could throw a soft jab if you tap a button, but throw a hard punch if he press and hold the same button).

**Microsoft** later debuted its **Xbox** controller. It incorporated the **PS2**'s rubber topped "Push button" analog mini joysticks (Now called a "**Thumb-Stick**") and internal rumble features. It also featured an upgrade slot similar to **N64** and **Dreamcast** for portable game saves. It also featured the two trigger button layout similar to the **Dreamcast**, and used the standard 4 button cross-shaped layout with 2 additional buttons placed below. The placement of the digital pad and analog sticks were switched compared to the **PS2** controller. The digital pad was no longer on the traditional far left, but was now placed towards the left-center. The **Xbox** controller did add one unique feature. The cords were made even longer then standard (9 feet), and had a "break away" connector to prevent the console from being pulled if the cord is snagged or stepped on. There were complains about the original controller size, but **Microsoft** later released an **S-Type** controller to meet the needs of smaller hands.

**Nintendo** stepped up to once again try and revolutionize gaming controllers. The **Nintendo Gamecube** controller pretty much featured the same digital pad and 2 analog thumb sticks like the **Xbox** and **PS2** pads. It also featured built in rumble capabilities. **Nintendo** also elected to switch the placement of the digital and analog pads (same as **Xbox**). **Nintendo** also did away with the upgrade slot. The **Gamecube** controller design is made with more emphasis on ergonomics. The controller is shaped for good grip even with small hands (grips similar to **Sony**'s **Dual Shock**). They added an oversized "A" button, standard "B" button, and curved "X and Y" buttons. The layout was meant to eliminate the need for a gamer to ever glance at the controller by offering a "home" button with the others just a roll of the thumb away. The shoulder buttons have been contoured for comfortable finger access. The shoulder buttons are also pressure sensitive analog (like **PS2**), but have a digital-click function. This allows each shoulder button to act like 2 action buttons. Simply press normal for an analog action or push all the way till it clicks for a digital action. **Nintendo** added an additional shoulder button on the right side to serve as a "Z" button.


All three of the current consoles offer similar features and capability, but ergonomic and game play factors vary depending on type of game and the game player. All in all it is interesting how controllers have evolved. All of the controllers used today have borrowed features from a previous console's controller design. It will be interesting to see how controllers evolve in the near future. In the meantime, check out the evolution of another aspect of controllers. The evolution of wireless controllers...

## Wireless Controllers - The Beginning

Gamers really had it bad in the early 1970's. They had to play on a controller that was built into the console. Things got better for gamers when game controllers began to feature cords that would let them play away from their console. Controller cords made gaming easier, but brought their own share of problems. The controller cords could become entangled. They also became tripping hazards. Nothing could be worse then having the dog (or some young blind sibling or cousin) trip on your cord and either knock down your precious console, or destroy any progress you had made in a particular game. Some gamers would grow tired of being leashed like dogs to their game console (cords ranged from 3 to 9 feet in length). It would be inevitable that cordless / wireless gaming would become the next stage of controller development.

Wireless game controllers have actually been around for quite some time. **Atari** experimented with wireless technology in the early 1980's. A prototype wireless system called the **Atari 2700** never saw the light of day, but the same **Radio Frequency** (**RF**) technology was used for a set of wireless joysticks for the **Atari 2600**.

**Atari**'s **CX-42** wireless joysticks used the same **RF** frequency range used for garage door openers, walk-talkies, or radio controlled cars / planes (27 MHz or 49 MHz). The controller movements would transmit signals to a receiver that connected to your **Atari 2600**. The concept did in fact give gamers the freedom to move at ranges of 20 to 30 feet from the receiver. However, the controllers were large and bulky. The receiver had to be plugged into an AC wall outlet, and each joystick required a 9V battery. Other then the complaints about the bulkiness, gamers complained about poor battery life and controller lag (slow on screen responses to gamers controller movements). We would not have been surprised if there were also complaints about garage doors randomly opening (hehe).

Between the mid 1980's and early 1990's game controllers evolved to include more button inputs. Developers continued their pursuit for wireless gaming, but required something to produce better results. They abandoned **Atari**'s use of **RF** technology in favor on the same infrared technology used on remote controls prevalent with televisions and **VCR** / **DVD** players.

**Infrared** (**IR**) controllers provided the ability to play games wirelessly at up to 25ft (762cm). The commands were transmitted to a sensor mounted on your console and would not effect any other appliances (garage owners breathes a sigh of relief).

**IR** controllers also had their own deficiencies. The controllers required an uninterrupted line of sight between the controller and the machine. This meant that you would lose control if something (or someone) got between you and your console. It also meant that you had to point the controller directly at the sensor.

There were many 3rd Party developed **IR** controllers (examples: **Acclaim** & **MadCatz**), but some official **IR** controllers were **Nintendo's NES Satellite** and **Sega's MK-1646-50 model II** for **Genesis**.

**IR** wireless controllers continued to be used well into 2000, but the technology would fail to meet the requirements of newer consoles. Controllers began to feature more functions and capabilities, and infrared could not handle the higher data transfer requirements needed. Also infrared could only transfer data in one direction (controller to sensor), so features such as "Force Feedback" (rumble) could not be reproduced (console sends the signal back to the controller to initiate rumble). Developers would once again use **RF** technology for wireless controllers. It just happened to be the same technology being used with cordless phones.

Developers began to use the regulated frequency ranges of 902 to 928 MHz (433.050 to 434.790 MHz and 869.700 to 870.000 MHz in European countries). These frequency ranges allowed a higher two-way data transfer that was omni-directional (doesn't have to be pointed directly at sensor) and had 4 or more available channels for multiple controller usage. One of the first controllers to debut with this technology was a 3rd party controller (**AirPlay**) for the **Sony Playstation**.

It was only a matter of time before developers would take advantage of the higher 2.4 GHz frequency **Wi-Fi** (**Wireless Fidelity**) technologies. The high data rate capability and refresh rates corrected the past issues of lag. The frequency range also required less power, and so battery consumption issues were addressed. Gamers could now have

There are quite a few 3rd party companies that have produced 2.4 GHz wireless controllers, but **Nintendo** was the first console developer of this time to debut their own **WaveBird** controller for **Gamecube**.

So what new wireless developments will surface in the future? The current technology is reliable, but has its own issues (some conflicts may occur if controllers are within the frequency range of computer wireless networks or 2.4GHz cordless phones). **BlueTooth** perhaps? Read on...

## Wireless Controllers - Advanced Models

**Microsoft** entered the 7th generation of console gaming with the knowledge that 2.4 GHz **Wi-Fi** still had much to offer. Their **Xbox 360** controllers shared the same button layout, thumb sticks, triggers, and force feedback as their original **Xbox** controller. However, they made great improvements on the ergonomic feel. Their new controller also features an additional button for direct **Xbox Live** access and a headset jack for in game communications. The controller can work wirelessly up to 30 ft (914 cm), and can run up to 40 hours on 2 "AA" batteries. **Microsoft** sold a "Charge & Play" pack separately which allowed for a rechargeable battery pack. The controller even works on **Windows** based PC gaming.

**Microsoft** may have chosen to stick with **Wi-Fi**, but their console competition would decide on using a different wireless technology. **Bluetooth** is a wireless protocol utilizing short-range communications to transfer data over short distances from fixed and/or mobile devices. So what makes it different? It uses 2.4 GHz frequencies just like **Wi-Fi**, but **Bluetooth** uses different modulation techniques. **Bluetooth** avoids other devices like cordless phones and **Wi-Fi** networks by dividing communications into 79 channels that change up to 1600 times per second. While **Wi-Fi** was primarily designed for wirelessly networking computers, **Bluetooth** was designed to act like an invisible cable connecting devices. It can create wireless personal area networks (**PAN**s) with one master device communicating with 7 other devices. It uses very little power, and easily connects other **Bluetooth** devices by "discovering" them when near each other. No fancy configuration is needed.

**Sony** decided to take advantage of **Bluetooth** technology for their **Playstation 3** console. Their initial controller release was called **SIXAXIS**. The controller used **Bluetooth 2.0**, which gives the controller the ability to operate wirelessly at a distance of approximately 32 ft (10 Meters). The **Bluetooth** features allowed the **PS3** to have up to 7 controllers operating wirelessly and provided good controller battery life for up to 30 hours. It featured a rechargeable battery that can be charged during game play using a **USB** cord. The **SIXAXIS** resembles the **DualShock 2** controller, but features better analog sensitivity. The controller's L2 / R2 buttons were also modified to work more like triggers. The old "Analog" mode button was also replaced with a jewel-like "PS" button that can be used to access menus or to turn the system on or off. LED lights were also added as indicators for charging or identifying players. The biggest deviation from the **DualShock 2** controller design was the removal of "Force Feedback" (rumble) support. **Sony** would later remedy this with the released of **DualShock 3**. The most unique innovation featured in both the **SIXAXIS** and **DualShock 3** is motion-sensing capabilities. The controllers contain a gyroscopic (accelerometer) sensor that can translate yaw, pitch and roll into onscreen action. In other words, the sensor can detect the angle you tilt the controller in your hands, and also how fast you are doing it. This added a new dimension of game play.


**Nintendo** has always been at the forefront of controller innovations, but their entry into the 7th Generation of consoles shocked many. Rather then a traditional controller design, the Nintendo Wii controller resembles a TV remote control (thus the name **Wii Remote** or **Wii-mote**). It was designed for single-handed game play, features a D-Pad near its tip, an enlarged "A" button and a trigger "B" button underneath. The traditional "Start" and "Select" buttons were changed to plus ("+") and minus ("Â¢â‚¬Œ") and the "Y" and "Z" buttons were changed to "1" and "2" to differentiate them from the "A" and "B" buttons. The button layout works for easy button access, but also functions as a classic controller when the **Wii-Mote** is turned sideways. Blue mounted LED lights indicate what player you are and also function as battery life indicators. The **Wii-Mote** is powered by two "AA" batteries with a reported 30 hour play life on average.


The **Wii-Mote** also uses wireless **Bluetooth 2.0** and motion sensing technologies, but takes it an additional step forward. **Nintendo** added a **PixArt** optical sensor at the tip, allowing it to determine the direction you are pointing the controller. The optical tip communicates with an included **Wii Sensor Bar** that is mounted above or below your television and uses tried and true infrared technology. All that "tech magic" means is that the **Wii-Mote** can translate your movements into on screen action. Swing the controller like a sword, or a baseball bat, and the **Wii** replicates the action on screen. Good thing **Nintendo** included straps for those excited gamers with sweaty hands and limp wrist grips.

**Nintendo** also lumped in force feedback (rumble) and an independent speaker on the face of the unit for special game sound effects. **Nintendo** must have wanted to cement their title as controller innovators because they also included 16 KB of memory with 6 KB that can be freely read and written by the **Wii**. This can be used to store **Mii** avatars, game controller configurations or whatever else creative programmers come up with into the **Wii-Mote**. They also added an expansion port at the bottom to attach additional devices like their pack in **Nunchuk** analog stick (that features its own motion sensing accelerometer), the **Wii Classic Controller** and more. The **Wii-Mote** can operate as far as 10 meters (30ft) for games that don't require the sensor bar and 5 meters for games that do.

**Nintendo** has definitely upped the anti as far as controller innovation. It will be interesting to see how game controllers evolve in the future.