chapter 1

Hardware Wars

Sigh.

I hate to do this to you because you seem like such a nice person, but every book has to start with the writer assuming that the reader knows *little or nothing* about the topic the book is about. My fondest wish is that you already know enough about tablet gaming that I can dive right into professional-grade tips and techniques delivered in the most obscure jargon and arcane argot.

Alas, I cannot. While I am sure that your head isn't completely devoid of even the most basic of knowledge . . . what a handheld device is, what a video game is, what a touchscreen tablet is, and so forth, this is where I write the literary equivalent of talking . . . very . . . slowly . . . and for that, I deeply apologize.

Okay, future game design genius, let's start with some basic definitions:

Video game: A game people play on a video screen.

Touchscreen: An electronic visual display that can detect the user's touch.

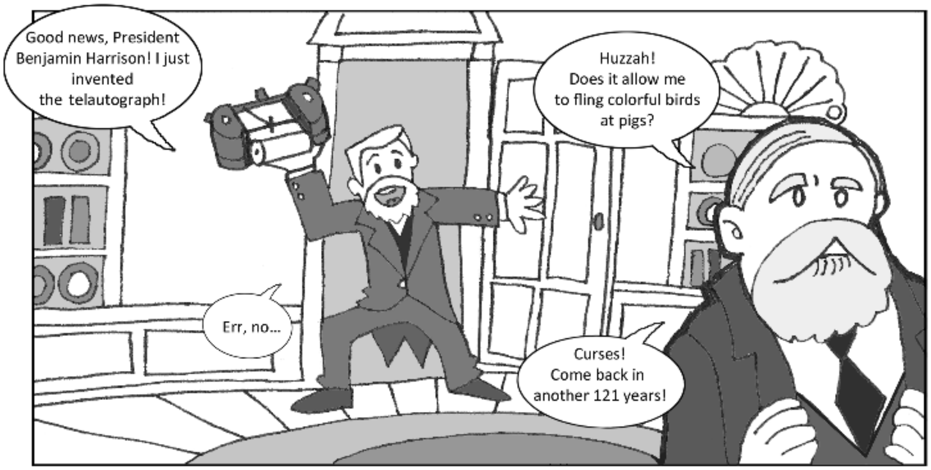
Tablet: A light, thin portable computer consisting mostly of just a touchscreen. Also known as a tablet computer.

Smartphone: A phone that (often) features a large touchscreen interface, possesses a fast processor, and provides additional features such as apps, access to the internet, and video playback. Of course, this book only applies to designing for smartphones with touchscreens.

Handheld gaming system: A dedicated video game playing device that users hold in their hands.

Sorry about that, but it had to be done. I believe that if you want to learn *how* to design a game for one of these gaming devices, you first need to know a little about the hardware and where it came from.[1] So let's pack some snacks and turn the dial on the way-back time machine to that brisk day in the fall of 1888 when not-so-young inventor Elias Gray burst into the Oval Office with a startling proclamation:

[1]"The electronics store" is not an acceptable answer.



At least that's the way I heard it.

The ***telautograph*** was a pretty awesome invention for the 1800s. A machine that could write . . . with a pen. Okay, maybe it wasn't as cool as a giant mechanical steam-powered spider, but the telautograph enabled users to transmit a drawing electronically. Documents could be signed over long distances, essentially making it the first fax machine. This is why we fought the robot civil war, to prevent machines from having better penmanship than us! Over the years, the technology stemming from Gray's invention split into two directions—handwriting recognition technology and image reproduction. The copyright for telautograph was eventually bought by a brash start-up called Xerox. I wonder how they did?

Flash forward to the 1950s: the atomic age, the era of three-piece suits and three-martini lunches. It is against this backdrop that a member of the think-tank known as the RAND Corporation barged into the Oval Office with another astounding announcement:

Next dateline: 1962. The Lincoln computer lab of the Massachusetts Institute of Technology (MIT) saw the birth of two significant technological advances that would eventually converge almost 25 years later. *Spacewar!*, one of the earliest video games, was created on the lab's DEC PDP-1 computer by three students: Steve "Slug" Russell, Martin "Shag" Graetz, and Wayne Witaenem. Meanwhile, Ivan Sutherland[2] presented his Ph.D. doctorate thesis, "Sketchpad: A Man-Machine Graphical Communication System," which allowed the user to input simple lines and curves by drawing directly onto a CRT screen with a light pen. Although originally two dimensional, Sketchpad was upgraded to display all three dimensions. Sutherland's invention created the field of ***computer-aided design*** (or *CAD*). Since a single graphical display CRT monitor cost $40,000, not including the computer you needed to run the software, CAD was not widely available except by computer scientists at universities and the military. Eventually, CAD found its way into commercial industries—automotives, aerospace, engineering, architecture, and film special effects.[3] These last two industries would later have a great influence on video game creators.

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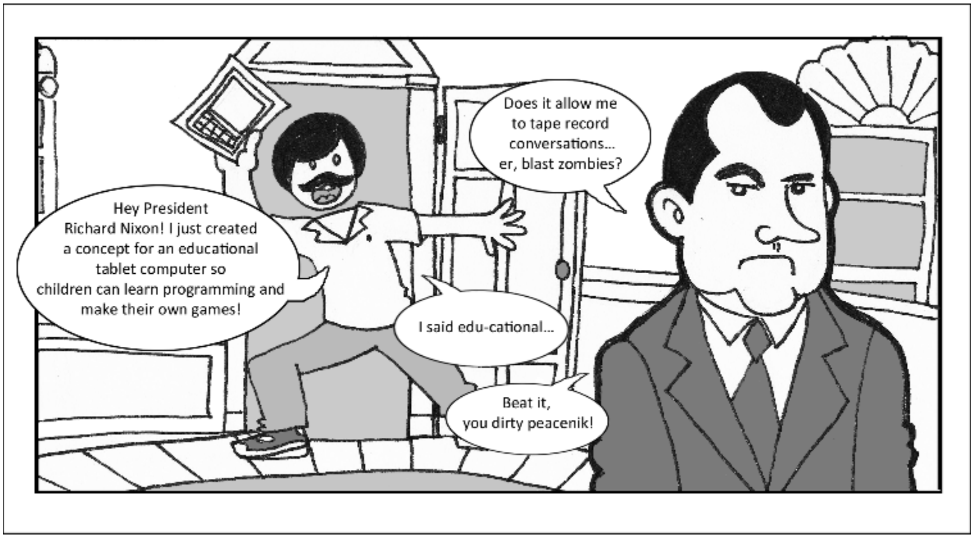
[2]Not only did Sutherland invent computer graphics, but he was the father of virtual reality, designing and building a VR headset in the late 1960s. This invention gave video games yet another gift: the concept of the word ***HUD*** *(heads-up display)*.

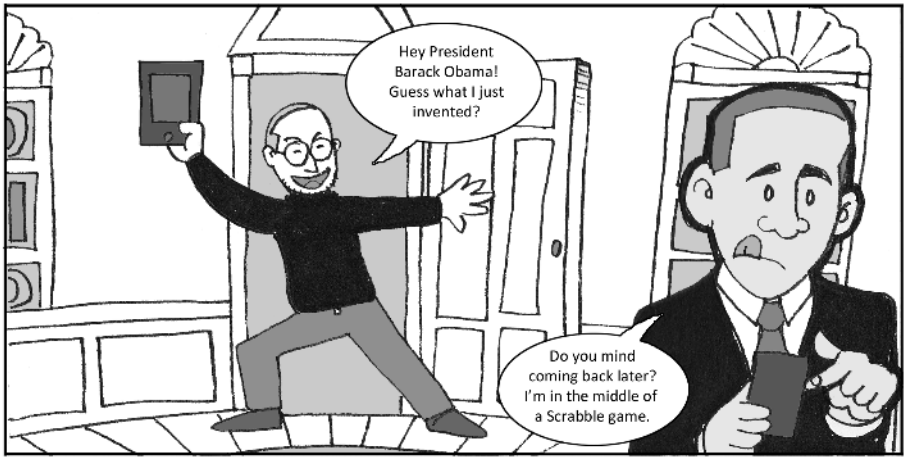
[3]The democratization of 3D modeling and animation tools is one of the great success stories of the personal computer and an important moment in video game development. When I was a young university student in the 1980s, my art and design instructors foretold that the future was creating objects in 3D. However, finding a computer on which I could learn the available software proved to be extremely difficult. Many of the early 3D artists and architects guarded their systems as fiercely as Templar Knights protecting the Holy Grail. Fortunately, more affordable 3D modeling and animation tools like Alias and 3D Studio Max came along, pushing these Knights aside and allowing everyone a seat at the 3D party.

Next stop, Stardate: 1966. A time when *Star Trek* first aired on television and science fiction nerds were just climbing out of the primordial ooze. Even to these prehistoric Trekkies, tablet computers seemed like science fiction, like the tricorder used by the crew of the Enterprise. However, computer scientist Alan Kay must have visited the City on the Edge of Forever when he designed the ***Dynabook*** in 1968. The design for this early tablet laptop was way ahead of its time and provided inspiration and the technological foundation for today's e-readers and tablet computers.[4]



Sadly, the Dynabook never made it past the concept phase, but many of its ideas paved the way for the first Apple handheld device in 1993—the Apple Newton. This handheld PDA (personal digital assistant) was an electronic notepad, allowing its owner to use a pen to write notes, create spreadsheets, and keep an events calendar. Flinging angry birds was still many years off, however. Despite this significant omission, the success of the Newton gave Apple the confidence to give tablet technology a second try in the 2000s; this time, the company had phenomenal success with the creation of the iPod touch, iPhone, and iPad tablet.

[4]http://www.tomshardware.com/news/alan-kay-steve-jobs-ipad-iphone,10209.html



Hooray! We've returned back from the past and we didn't even have to watch our parents make out at the Enchantment-Under-The-Sea ball! Since one out of 43 U.S. presidents agree that touchscreen gaming is pretty keen, let's examine this amazing technology further.

Touch and Go!

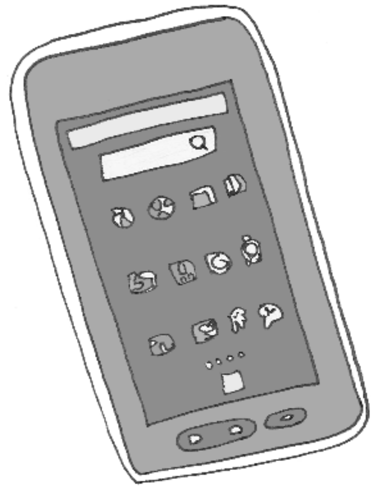
The great thing about technology is there are different ways to achieve the same results. Want to get airborne? An airplane, helicopter, balloon, and catapult all do the trick![5] The same is true with touchscreens. While they all look the same on the outside, there is a difference depending on what's going on beneath those cold, shiny exteriors. Each technology has its own advantages and restrictions that are important for designers to be aware of. There are five types of tablets: capacitive, resistive, passive, electromagnetic, and inductive.

A ***capacitive tablet*** detects the electrostatic signal generated by porous materials such as conductive foam or . . . ick . . . human skin. Most modern tablet PCs use capacitive signals to detect user input, eliminating the need for a stylus; a human finger works just as well! Capacitive tablets can support multi-touch capability; the current iPad can detect up to 11 touch points! Disadvantages include having to frequently clean your tablet's screen due to the user's Cheetos-stained fingers.

iPhone touch screen

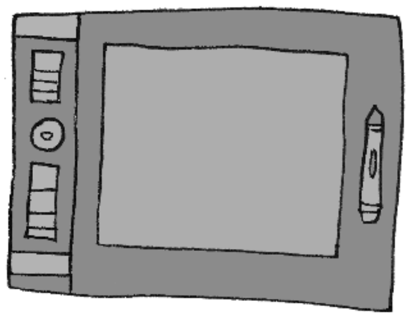
[5]Though your landing experience may be radically different in each case.

Resistive tablets are touchscreens that require physical pressure to operate and are found in devices like the Nintendo DS, low-end tablet PCs, and those pads at the supermarket that you have to sign if you use a credit card to buy your groceries.



Resistive screen tablet

Resistive touchscreens are created by layering two screens that activate when the top layer is forced into contact with the bottom layer. Styli are often used to increase precision on the screen although they don't need them to operate. They just help increase the accuracy as it's easier to be precise with the tip of a pen than it is with a big ol' sausage finger. Resistive screens are very cheap to produce, but they generally don't handle multi-touch functionality and lack durability. Even worse, you can lose those styli under your couch.



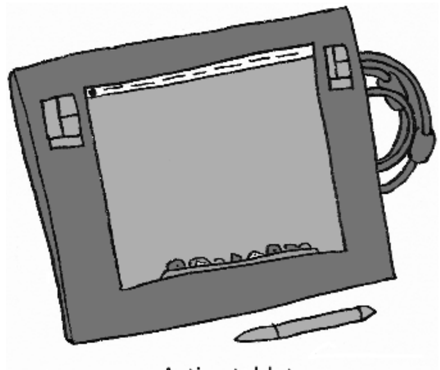
Wacom tablet

Passive tablets are most commonly found in drawing tablets that use a stylus or "light pen." The battery-powered stylus generates a ***resonant circuit*** or ***LC circuit*** that reacts with criss-crossed wires inside the tablet. The wires act as receiving coils for the LC circuit and cause electromagnetic induction. In other words, the tablet becomes an electromagnetic tuning fork. A passive tablet is so sensitive the user doesn't even have to touch the surface of the tablet to draw. By changing pressure on the stylus nib or pressing a switch on the stylus, the signal generated by the pen changes, allowing for different line effects such as line weight, which simulates adding or removing pressure. It's much like drawing with a pencil (except you never have to sharpen your pencil!).

Passive tablets like those made by Wacom and THQ's UDraw are not tablet computers, but rather peripherals that require additional software or a gaming console to operate. These devices are included in *Swipe This!* because (a) they are touchscreen gaming systems and (b) you design games for them as you would any other touchscreen device.

Electromagnetic tablets are cousins to passive tablets, but the tablet detects the pen rather than vice-versa with the passive tablet. In other words, the EM tablet is "smart" and its pen is "dumb."

An ***inductive touchscreen tablet*** differs from the passive tablet in that their "smart pen" stylus houses electronics that transmit an electromagnetic signal to the tablet to determine the user's position.[6] It constantly watches every move you make![7] The pen transmits information about pressure, button presses, and the user's movements to the tablet. These active tablets allow users to draw smoother lines and their screens have the highest precision, but they are very expensive. This is why professional artists use them. These artists do not have time for video games. They're too busy making them, which is also why you don't see too many games designed specifically for these devices. Sure, there are a few games you can play on an active tablet: browser games like *Line Rider* (Boštjan Čadež, 2006) and *Scribble* (Nitrome, 2006). Any game that can be played on a computer monitor can be played on an active tablet because it is an accessory, not a PC. A bummer about active tablets is that if you lose or break an active tablet stylus, it can be expensive to replace. You don't want to risk that happening, so maybe you're better off not playing games on an inductive touchscreen.

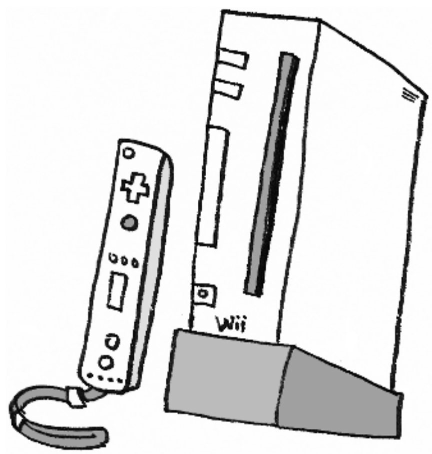


Active tablet

More Things to Be Touchy About

There are a few other input systems that live with (or at least in the same neighborhood) as the ones listed above: ***optical*** and ***acoustic*** systems.

An ***optical tablet*** uses a small camera in the stylus to match an image being drawn on the tablet. The camera tracks the motions and marks created by the user and then translates them to data that is reproduced on-screen. While optical tablets are the great-great-grandchild of the telautograph, the technology is still in use today. For example, the Nintendo Wii uses similar technology[8] to track the movement of the Wii Remote for drawing games such as *Drawn to Life: The Next Chapter* (THQ, 2008) and *Okami* (Capcom, 2008). However, precision drawing is not always possible with an optical control system. I talk about techniques and tricks to overcome this challenge in Chapter 3.



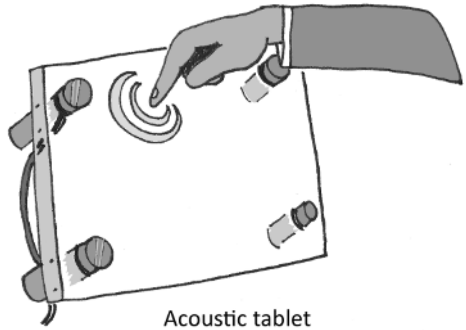
Nintendo Wii

[6] This might be the most scientific sentence I write in this book.

[7] It might be time to start up the robot civil wars again.

[8] Keep in mind that I'm not calling the Wii Remote a tablet, I'm just illustrating that it uses the motion camera system. Geez, you're so literal!

An ***acoustic tablet*** uses microphones to determine the placement of the stylus, allowing for greater fidelity in determining the stylus's position in 3D space. Acoustic transducers can be used to register distinctive finger taps and scrapes to control functions formerly done with traditional buttons or other control mechanisms.[9] Currently, no existing game systems use this technology, but some recent tablet PC patents indicate that they might be in the near future. Start growing those fingernails and get prepared now!


Acoustic tablet

And this is just the beginning! Touchscreen technology will evolve even further as the tablet-arms race ramps up. How many touchpoints will future touchscreens be able to support? Just how many digits will it take to satisfy touchscreen users? Twelve? Thirteen? Toes? Now that we've examined the types of touchscreens available, just what can we play on them?

Game On!

Why, games of course! A common misconception is confusing a game with an app. "What about apps? Where do they fall into all of this?" I hear you cry. To learn the difference, here are some more of those ever-useful definitions:

Mobile optimized: A website or web application specifically designed and developed for the dimensions, interactions, and performance of a web browser on an Apple iPod touch, iPhone, or iPad. By creating content for use on multiple platforms, development costs are reduced and money and content can be regularly updated via the website rather than the user. Less memory is dedicated to the app since data can be pulled down from the interwebs or cloud. The downside is users might not be able to access the data if they are in a dead spot or their cell service is poor. No service = no game. No game = sadness.

Native application: A program designed and developed to run independent of a web browser, compiled specifically for an Apple iPod touch, iPhone, or iPad. Native apps load and run faster as the data is resident in the device's memory. The downside is this data can get large (especially art, sound, and video files) and fill up your device's storage quickly. If an app is too big, the user might be compelled to remove it after a while to make room for more Lady Gaga songs. Also, Apple doesn't allow wireless data transfers larger than 50MB: any bigger and it has to be done while the device is connected to the user's computer. Not a huge disadvantage, but you can't get that big game if you aren't next to your computer. Once again, sadness.

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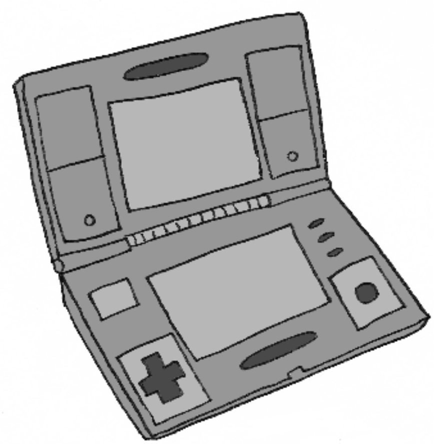
[9]For a really cool example of how acoustic transducers work, watch `http://www.youtube.com/watch?feature=player_embedded&v=2E8vsQB4`.

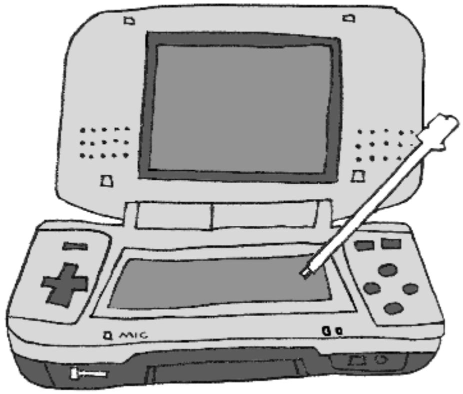
But it's not all rainclouds and pouty faces in mobile gaming land. No matter which way you store the data, the big advantage is that the player can access it (almost) at any time. It is this "on-demand" system that helps make downloadable gaming (using the App Store or the Android Market) so popular. Less than a decade ago, the only option for publishing games for handheld devices was printable media: cartridges and optical media like UMDs (the Playstation Portable's native media). This recent development in downloadable gaming has changed the face of the industry, forcing many hardware developers to adopt online methods of downloading games or risk being left behind. Let's look at the existing handheld gaming systems and see what options they offer:

First up is the Nintendo Dual Screen Portable Gaming System, more commonly known as the ***Nintendo DS.*** The physical design of the Nintendo DS was inspired by Nintendo's first foray in portable gaming: the ***Game & Watch*** (Nintendo, 1980) and the extension of the long running line of Nintendo portable game systems: the Game Boy, Game Boy Color, and Game Boy Advance. Game & Watch was a line of charming single-game devices, with gameplay displayed on an LCD screen. In 1982, the line expanded to include dual-screened games that featured famous Nintendo characters such as Donkey Kong,[10] Link (of *Legend of Zelda* fame), and the eternally hapless hero Mr. Game & Watch, the star of Game & Watch titles including *Ball*, *Fire,* and *Oil Panic.*


Nintendo Game & Watch

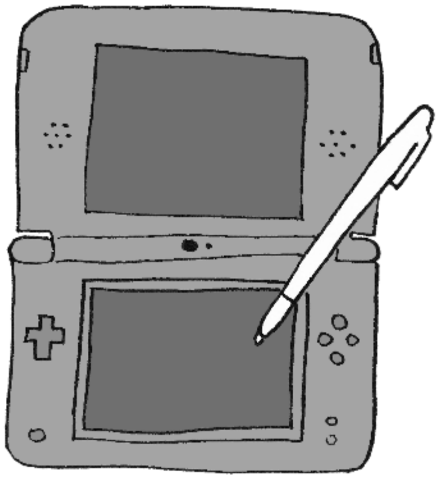
[10]The Donkey Kong dual-screen Game & Watch was a thing of beauty. My best friend's father bought one for me while in Japan. The game characters were made up of frantic LED-drawn silhouettes that flicked across the screen as you operated the d-pad. The cover of my orange Game & Watch was inlaid with some sort of mysterious metallic material that seemed like it came from outer space, that shimmered and glistened and mesmerized my 12-year-old eyes. Aesthetically and functionally, that Donkey Kong Game & Watch was gorgeous. Sadly, I had to sell mine to pay rent in college. But if anyone wants to send me one care of my publisher, I won't complain!

The Nintendo DS was released in 2004, with more than a few improvements over its ancestor. The Nintendo DS dazzled gamers with its twin color screens, slots for two game cartridges (which supported both Nintendo DS and Game Boy Advance titles), a built-in microphone, Wi-Fi connectivity to allow multiple Nintendo DSs to communicate, and most impressively, a single touchscreen that could be operated by a stylus. Early hits on this system included Nintendo's *Brain Age, Wario Ware Touched!,* and a port of *Mario 64* (*Super Mario 64 DS*). The system exploded, however, with the release of *Nintendogs* (Nintendo, 2005), a real-time Tamgotchi-style game where you played with and trained a virtual dog.

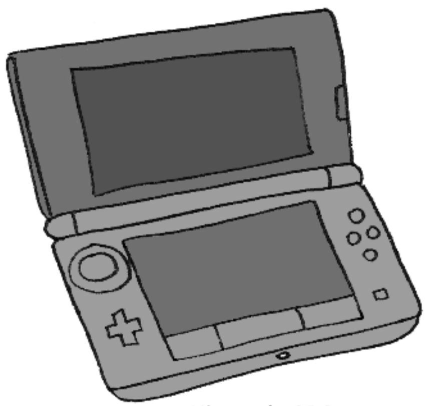


Nintendo DS

The Nintendo DS was popular enough to warrant four significant technology upgrades: The ***Nintendo DS Lite*** (Nintendo, 2006) featured a larger and clearer screen while slimming down the hardware to fit easily in a pocket. The ***Nintendo DSi*** (Nintendo, 2008) added built-in memory, dual cameras with image and sound editing tools, and the ability to connect to the ***DSiWare shop*** (also launched in 2008); an online store with downloadable new and classic games and applications, and share user-created content in programs such as the animation tool *Flipbook*. The ***Nintendo DSi XL*** added an even bigger display screen. The ***Nintendo 3DS*** (Nintendo, 2011) introduced a "glasses-free" 3D screen up top, twin cameras that allow gamers to capture true 3D images, an accelerometer, a gyroscope, an analog control pad, and the ability to play built-in augmented reality (or ***AR***) games.



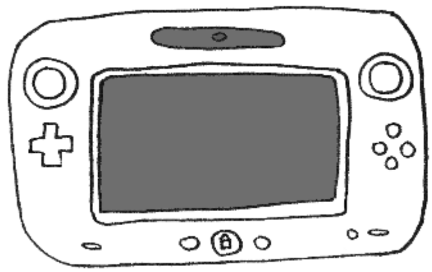
Nintendo DS XL



Nintendo 3DS

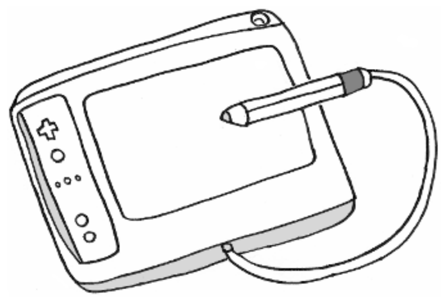
Despite all of these great features, backward compatibility was sacrificed over the evolution of the system. Players could still play their Game Boy Advance titles on the Nintendo DS all the way through to the Nintendo DSXL. But the functionality was removed for the Nintendo DSi. While the Nintendo 3DS can still play Nintendo DS titles, older systems cannot play new Nintendo 3DS games. Despite this, all five versions of the Nintendo DS have sold more than 146.4 units—impressive numbers when compared to recent "major" gaming consoles: the Playstation 3 and Xbox 360.[11]

At the 2011 Electronic Entertainment Expo, Nintendo revealed its next step in touchscreen gaming, the ***Wii U.*** The Wii U's "controller" appears to be the oversized love child of the Wii console and the DSi. The Wii U's flat tablet controller features a centrally mounted touchscreen, an accelerometer, and an impressive amount of analog, digital, and trigger controllers. An early advantage to the Wii U controller is that since it works in conjunction with your TV set, the player's hand won't get in the way of any on-screen action. We'll just have to wait to see what innovative control and gameplay this brings to the party. Expectations are high, but whether the Wii U ends up as the next Wii or the next ***Virtual Boy***[12] remains to be seen.



Nintendo Wii U

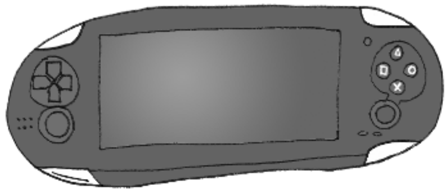
The ***UDraw*** (THQ, 2010) is the most traditional drawing tablet available for consoles, similar to those manufactured by Wacom and others. The UDraw is a peripheral for the Nintendo Wii and connects via the console's Wii-Mote controller. Players use the UDraw's stylus to draw, write, and control game characters. Unlike the other gaming devices we've been talking about, though, it has no visual screen of its own. However, many of the game design conventions I talk about in *Swipe This!* still hold true for the UDraw.



UDraw tablet

[11]As of 2011, the PS3 had sold 51.8 million units and the Xbox 360 sold 55 million units worldwide.

[12]The Virtual Boy was one of Nintendo's few flops. The 1995 portable gaming system resembled a pair of large red goggles connected to a controller and balanced precariously on a flimsy tripod. The Virtual Boy promised "true 3D" graphics for the player . . . and delivered true 3D all right, but in monochromatic red graphics that induced violent headaches in many users (including yours truly). To no one's surprise, the Virtual Boy was discontinued in less than a year.



Playstation Vita

Another gaming system that debuted at the 2011 E3 is the ***Playstation Vita*** (formerly known as the NGP and the PSP2). The system boosts several control options, including analog buttons, control buttons, an accelerometer, and two cameras (one front, one rear). The device supports Bluetooth, Wi-Fi, and 3G connectivity. But the most innovative feature is its twin touchscreens—a front-facing OLED multi-touch capacitive screen facing the player and a rear-facing capacitive touchpad that can be controlled by the user's fingers. This screen has no visual component and is used for game control functions only. Several of Sony's top design teams are creating content for the Vita, and it will be interesting to see how they incorporate this "blind screen" into gameplay. I talk about some gameplay ideas regarding this later on in the book. Stay tuned!

Not all gaming devices start out as gaming devices. Introduced in 2007, the Apple ***iPhone*** was conceived by then-CEO Steve Jobs as a combination of Apple's wildly popular iPod music player, a mobile phone and an "Internet communicator." The iPhone's large multi-touch touchscreen, with 320-by-480 pixel color resolution combined with Apple's trademark user-friendly, icon-based interface made the iPhone an instant success: Initial shipments sold out in hours, and 1 million units sold within the first 5 days of release. A 2011 report estimates that more than 128 million iPhones have been sold worldwide,[13] making it the second most dominant gaming platform in the world, behind the Nintendo DS.

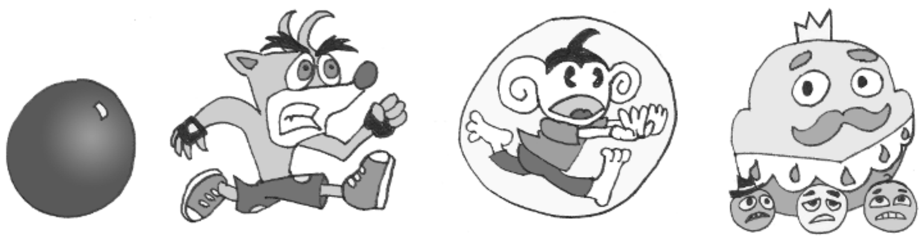
In 2007, Apple released the ***iPod touch,*** essentially an iPhone without the phone, or an iPod with a touchscreen (take your pick), which featured similar controls and functions.

iPhone

[13]This estimate includes the original iPhone, the iPhone 3G/3GS, and iPhone 4 models.

That touchscreen meant games! Gaming blossomed on the iPod touch, but at first finding and downloading games was another matter. Gaming apps were available on individual publishers' websites, but if you didn't know what you were looking for or how to get them from your computer onto your device, then it could be a confusing and cumbersome process. The breakthrough came a year later. The debut of the iTunes iOS App Store[14] in 2008 transformed Apple's iOS devices into a major gaming platform.

On launch day, around 160 games[15] were available for purchase and the App Store had the secret sauce that few other game stores had: It never closed[16]. Gamers could (relatively) easily find and download games directly onto their iOS devices, and games were sold at prices much lower[17] than console or computer titles. This change in sales strategy (sell low but potentially sell massive volumes) is making a huge impact on the gaming industry: we'll talk about this in Chapter 11. In the meantime, you can find a list of the games available on the opening day of the App Store (and which ones you can still purchase today) in Appendix 1.



The most popular iOS game releases of 2008 included *Crash Bandicoot Nitro Kart 3D* (Activision, 2008), *Super Monkey Ball* (Sega, 2008), *Rolando* (ngmoco, 2008), and *Labyrinth* (Illusion Labs, 2008). These early games focused on one of the iPhone's more popular features: the built-in gyroscope that allowed for tilt control.[18] Soon, games of all genres were available in the App Store.

[14]iTunes was established in 2003 to support the Apple iPod digital music player.

[15]`http://toucharcade.com/2008/07/10/app-store-to-launch-with-about-160-games`

[16]Steam, Valve's online game store was one of the first to the "all-games-all-the-time party" back in 2003.

[17]App Store game prices generally ranged from $.99 to $9.99.

[18]We'll go full tilt on the subject of gyroscopes in Chapter 3.

Gaming on Apple devices got a major boost in 2010 with the release of the ***iPad*** tablet computer, which featured a 9.7-inch (diagonal) screen with a resolution of 768 × 1024 pixels; coupled with all the functions of the iPod touch and the iPhone (except, of course, the phone), the iPad was perfect for gaming. Even people with enormous fingers (like yours truly) could appreciate content delivered by the App Store.


iPad

When Google announced its ***Android*** operating system (OS) as a competitor to Apple, hardware manufacturers quickly jumped onto the tablet computer bandwagon. In fact in 2009 the Archos 5, the first Android tablet, beat the iPad to market. Tablets like the Samsung ***Galaxy Tab,*** HP ***TouchPad,*** and Motorola ***Xoom*** bear many similarities to Apple's products: large touchscreen, accelerometer, and so forth; a few others, like the Asus ***Eee Pad Transformer,*** have features like a keyboard dock that distinguish them from their competitors. On the touchscreen mobile phone front, notable examples include the ***Palm Pre*** (and ***Pre Plus*** and ***Pre 2***) and ***Palm Pixi*** multimedia smartphones whose ***WebOS*** offers a Linux-based solution and Accunture's ***Symbian*** operating system found on many Nokia smartphones. An interesting development on the smartphone front was 2010's introduction of the ***Windows Phone 7*** OS, which gives players access to Microsoft's Xbox Live! and a direct link to their "full" console experience.

As you can see, gamers have plenty of exciting hardware options. And by the time you read these words, I'm sure there will have been yet another new and exciting touchscreen system announced. So, how can a game designer stave off the constant march of technology and keep ahead? Can a game designer actually predict the future?[19]

[19]No.

Destroy All Humans!

Ah, the future. What will it be like? What is the future of these gaming devices? What if these gaming systems become obsolete? What will replace them? Will the robots eventually destroy us all? What's coming next? These are all good questions that I do not know the answers to. If I did, I'd be running down to the patent office with the designs for the next iPhone[20] rather than writing this!

But, dear reader and fellow human,[21] do not worry—the future is bright! While touchscreen gaming technology is always evolving, the basics of gameplay design remain the same. And this is what we will be learning in the next chapter, so let's get moving before the robots attack!

[20]Unfortunately, my time machine only goes backward.

[21]You are human, aren't you?