

Moore's Law and electronic games

*How technology advances will
take electronic games everywhere*

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1. Foreword

Throughout the twentieth century, scores of companies and their investors have made their fortunes from correctly anticipating and exploiting technological progress. Conversely, the failure to anticipate either technology's progress or its tardiness has destroyed billions of dollars in shareholder value and investor capital.

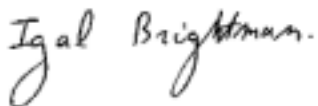
Innovations as diverse and profound as the talkie movie, the word processor and online business information have disrupted entire industries, yet ultimately invigorated them – creating new companies and sectors in the process.

The electronic game industry is in the middle of just such a transformation. What was once a minor industry niche has evolved into one of the most dominant sectors in the media and entertainment business – capitalizing on technological advances – and that spectacular growth has the potential to continue through the end of the decade.

Moore's Law, which observes a doubling in processor power every two years, is expected to hold true until at least 2010. Network connectivity (fixed and wireless) and storage capacity (hard disk and solid state) are also expected to improve significantly in that same time period.

This report considers the impact that continuing technological advances will have not only on today's electronic game industry, but also on the growing number of industries that are significantly affected by the electronic game industry, including: music, movies, consumer electronics, advertising, communications and traditional toy manufacturing.

On behalf of Deloitte's global Technology, Media and Telecommunications group, I hope you find our latest Deloitte Research report insightful, thought-provoking and valuable.



Igal Brightman

Global Managing Partner
Technology, Media and Telecommunications



2. Management summary



The electronic game industry is big business – and getting bigger. Ten years back, electronic games were just a blip on the media industry radar screen. But now, after several years of spectacular growth, the electronic game industry is one of the most dominant players in the media sector – with revenues rivaling those of the long-established music and motion picture industries. For example, in 2001 in the US, sales of video games and related hardware climbed to \$9.4 billion – surpassing box office receipts of \$8.4 billion.

The industry's dramatic transformation is largely being driven by continuous technological advances. Electronic games have moved to the forefront of technology development, pushing – and being pushed by – the latest advances in technology (see Figure 1).

Electronic games and their underlying technologies are becoming increasingly pervasive, with influence that is extending far beyond the industry's historical boundaries. Games have already made the jump from PCs and dedicated consoles to mobile phones, MP3 players, PDAs, music and movies – and will soon spread into areas as diverse as toys and exercise machines.

We expect that the installed base of non-PC devices supporting paid-for electronic games will rise from 415 million in 2004 to at least 2.6 billion by 2010. This will be driven by increases in the number of traditional games consoles but more importantly by the sharp take-off in other consumer electronics devices – from mobile phones to set top boxes – that support individually purchased games.

Companies have begun to realize the potential impact of the electronic game industry and are jockeying for position. Sony and Microsoft are spending billions of dollars developing next-generation game consoles, and Nokia is selling a phone specifically designed for game playing. In the Asia Pacific regions, the three fastest-growing companies in the technology sector are involved in electronic games.

Looking forward: technology advances will sustain disruption in the electronic game market through 2010.

The electronic game sector provides one of the clearest examples of the fundamental impact that technological advances can have on an industry – and we expect that trend of technological disruption to be even more dramatic over the next six years. Significant advances are likely to occur in at least three key areas:

- **Processing power and transistor density.** Moore's Law states that the transistor density of a silicon chip will double every two years – implying an eight fold increase in processing power between now and 2010.
- **Network bandwidth.** By 2010 we expect nearly 450 million homes worldwide to have broadband connections, with 1 billion people having access to packet-switched mobile phone connections that could support some form of mobile games.
- **Storage capacity.** Empirical evidence since 1990 suggests that available storage grows 12 times faster than processor density, implying at least 1,000 Gb of disk storage in a typical home PC by 2010.

In the industry's early days, game consoles were designed to squeeze the maximum performance out of existing low-cost technologies. But today, fierce market competition is pushing video game technology to the forefront of integrated circuit development. Sony's PlayStation 3, which is expected to launch in 2006, reportedly features a processor capable of 1 trillion calculations per second. That is nearly 1,000 percent faster than the PlayStation 2 and roughly on par with some of today's supercomputers. Similar advances in memory density, storage capacity and connectivity will dramatically expand the capabilities of video game consoles and electronic game devices – supplanting other product categories and sending shock waves through a wide range of industries, from consumer electronics, software publishing and advertising to communications, entertainment and traditional toy manufacturing.

Home console manufacturers will battle for control of the living room. The biggest battles for electronic games will take place in the living room – and not just on the TV screen. Competition among video game console makers is already fierce and the stakes are getting higher. The two biggest players – Sony and Microsoft – are each spending billions of dollars in an arms race to develop their next generation of video game consoles. The objective? Not just dominance in the lucrative game market, but even more importantly, the pole position in a race toward digital convergence that is occurring in living rooms around the world.

Electronic game publishing will be increasingly stratified.

Advances in hardware technology will up the ante for software publishers – creating demand for games that are deeper and more sophisticated, yet much more costly to produce. Those steep entry requirements will drive smaller publishers out of the high-end console and PC markets. At the same time, industry expansion will open up new opportunities in other segments – with technology developments creating a more compelling game experience for mobile phones, PDAs and other portable game devices. Titles will be released on multiple platforms and sequels to popular titles will be increasingly common. Many games will also feature on-line play as a way to enhance the product's appeal and as a potential source of additional revenue.

In-game advertising will become commonplace. Escalating development costs for electronic games – and an expanding market with attractive demographics – will also create new opportunities for advertisers. Companies like McDonalds and Intel are already paying millions of dollars for in-game, fully-interactive product placements – a trend that is sure to grow.

Electronic games will drive demand for wireless data services and broadband. Online games and downloads will be increasingly popular – fueling the adoption of broadband – but opportunities for fixed operators to generate revenue directly from games will be limited. Mobile operators will profit from selling and distributing games for mobile phones, but we do not expect mobile online games to hold much appeal through 2010 – largely due to network limitations.

The line between movies and games will continue to blur – with licensing a major source of revenue. Movie studios have long recognized the value of merchandising, and electronic games represent an important new merchandising category. Blockbuster movies that inspire new games already command game license fees of more than \$10 million apiece – and that figure is certain to rise as software publishers look for ways to improve a game's chances for success. We will also see more instances of video games inspiring movies – as happened with **Tomb Raider** and **Mortal Kombat** – particularly as advances in technology make games more realistic and cinematic.

Music will be an increasingly important – and marketable – part of the electronic game experience. Record company revenue from in-game music will continue to rise – and music will be an increasingly important differentiator for games. Games with music as the central focus will also continue to grow in popularity. Hardware improvements will make music more of a factor on mobile phones and handheld devices.

Traditional toy manufacturers will take advantage of electronic games – instead of fighting it. In the future, successful toy makers will find new ways to capitalize on the growth and development of electronic games, using the technology to re-invigorate traditional toys and taking advantage of opportunities for cross-licensing.

Conclusions and recommendations

The electronic game industry is at the leading edge of technology development, driving – and being driven by – the latest advances in technology. These dual forces are spurring disruptive change that extends far beyond the traditional boundaries of the electronic game industry. As games become more ubiquitous, their influence will surely grow.

What can companies do to capitalize on this trend – instead of being consumed by it?

Brace for impact. The electronic game industry will affect a wide variety of companies, not just game publishers and console manufacturers.

Choose a niche. The highest profile opportunities are not necessarily the best – especially if a company does not have the resources or market power to be successful. Each company should consider its own unique capabilities and pick a market niche where it has a relative advantage.

Look ahead. The one sure bet is that technology is not going to stand still. To be successful, companies will need to stay on top of technological change, closely monitoring its progress and accurately predicting what it will allow them to do at specific points in the future.

Take the long-term view. Developing a new hardware platform or high-end game will require a major investment sustained over a number of years. Companies unwilling to make that commitment should invest elsewhere, or shift their focus to a less demanding niche.

Expect dramatic shifts. Although technology development is fairly predictable over the long-term, consumer demand and market dynamics are not. Companies should expect significant shifts in the market and be prepared to deal with them.

In less than a decade the electronic game industry has transformed itself from an industry niche to a global powerhouse – and that trend is expected to continue through at least 2010. Driven by the relentless force of Moore's Law, electronic games and their related technologies will generate shock waves that extend far beyond the electronic game sector – blurring the lines between industries and encroaching on existing product categories. Early movers like Sony and Microsoft are already spending billions of dollars to position themselves for market leadership – and many other companies are about to enter the fray. It is a risky game, but the risk of inaction is even higher – as are the potential rewards.

3. Introduction

Looking back: an industry transformed

In 1996, electronic games were just a blip on the media industry radar screen. PCs were the dominant game platform. Sony's first-generation game console – the PlayStation – had sold barely 4 million units worldwideⁱ. And most of the industry's customers were secondary students and pre-teens.

But now, after several years of spectacular growth, the electronic game industry is one of the most dominant players in the media sector – with revenues rivaling those of the long-established music and motion picture industries. In the US, in 2001, sales of video games and related hardware climbed to \$9.4 billion – surpassing box office receipts of \$8.4 billion.ⁱⁱ And in the UK – the third largest games market – electronic games currently outsell music singles by ten-to-one, with year-over-year sales for the third quarter of 2003 increasing by 13 percent to \$684 million.ⁱⁱⁱ

As of early 2004:

- Sony had sold 70 million units of its second generation video game console – the PlayStation 2.
- Microsoft had been enticed into the market – despite the multibillion-dollar ante – shaking up the industry with its Xbox console.
- Nokia, the world's largest mobile phones manufacturer, had announced the second version of a specialized game phone – with growing support from leading game publishers.
- Game-related companies were ranked among the fastest growing technology companies in the Asia-Pacific region.^{iv}

The market for electronic games has grown both in size and quality. Video games were once considered the exclusive domain of pimply-faced boys and pre-pubescents, but it appears a lot of those gamers have grown up. According to a recent survey by the Entertainment Software Association, the average age for game players is 29 years old. Forty one percent report a household income of more than \$50,000. And a surprising 43 percent of today's gamers are female – with 26 percent being women 18 or older. Those are very attractive demographics. Players have more money to spend on games, and they are spending more time playing them – causing a significant migration of eyeballs from traditional forms of entertainment such as television.

How did the electronic game industry achieve this dramatic transformation in such a short time? Largely by capitalizing on continuous advances in technology that made games more compelling, more affordable, more accessible – and ultimately, more fun (see Figure 1).

Looking forward: technology advances will sustain disruption in the electronic game market through 2010

The electronic game sector provides one of the clearest examples of the fundamental impact that technological advances can have on an industry – and we expect that trend of technological disruption to be even more dramatic over the next six years. Significant advances are likely to occur in at least three key areas:

- Processing power and transistor density.
- Storage capacity.
- Network bandwidth across fixed-line and wireless networks.

Advances in these areas will not only have a profound impact on incumbents of the electronic game industry, they will also create significant opportunities for companies in a wide range of other industries – from movie studios, record companies and advertisers to mobile phone producers, communications operators and electronics manufacturers.

Processor power and Moore's Law

Moore's Law is a widely accepted formula for predicting advances in semiconductor technology. It states that the transistor density of a silicon chip will double every two years, driving a similar improvement in processor performance. Our assumption – based on reports from IBM and Intel – is that Moore's Law will continue to hold true through 2010, implying an eight fold increase in processing power.

For video game consoles – particularly Sony's PlayStation 3 and Microsoft's Xbox 2 – the performance improvement from one generation to the next will be even more dramatic. Console makers used to be satisfied building their products around mainstream technologies that were proven and affordable. But today, the processors being developed for next-generation game consoles are at the forefront of integrated circuit development. The PlayStation 3, which is expected to launch in 2006, will feature a processor capable of 1 trillion calculations per second. That is nearly 1,000 percent faster than the PlayStation 2 – introduced in early 2000 – and roughly on par with some of today's supercomputers.

Other form factors will also benefit from significant increases in computing power. Processors in high-end mobile phones currently top out at 400 MHz, but are likely to reach speeds of 1.5 GHz by 2010, greatly increasing the possibilities for electronic games and other applications. Set-top boxes for televisions are likely to evolve into digital video recorders with broadband connections and built-in game capabilities. Those games may be provided on a pay-to-play basis, a value-added basis, or as an advertising-sponsored feature.

Figure 1: The growing power of electronic game consoles

Nintendo Entertainment System	Super Nintendo Entertainment Sysztem	Sony PlayStation	Nintendo 64	Sony PS2	Microsoft xbox
1985	1991	1994	1996	2000	2001
8-bit CPU, 2 MHz, 2 Kb RAM 2 Kb video memory, 16 color 128 Kbs RAM	16-bit, 2.68 to 3.58 MHz	32-bit running at 33.87 MHz RISC system 2Mb RAM 360 000 polygons a second. Media – CD	MIPS 64-bit RISC CPU (customized R4000 series) 93.75 MHz	294 MHz MIPS 128-bits 38 Mb 66 M/Polygons/s DVD/CD-ROM Sony Graphics Synthesizer 8 Mb Video Memory	733 MHz (Intel Pentium III) 64 Mb SDRAM 8 Gb hard disk 125 M/Polygon/s DVD/CD ROM 256 audio channels

Source: Deloitte Research, 2004

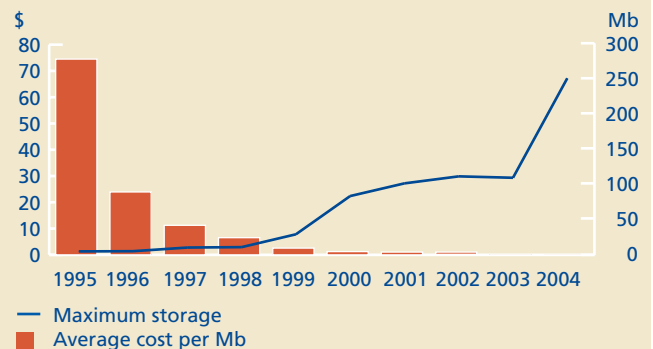
Storage capacity and Parkinson's Law

While there is no widely accepted law to predict advances in storage density, a tongue-in-cheek adage known as Parkinson's Law has proven itself fairly useful – and is likely to hold true for the electronic game market through 2010. Parkinson's Law states that data expands to fill the space available for storage. In other words, the more space you have, the more you will use – creating virtually unlimited demand for storage.

Hard drives and optical storage

Based on empirical observations of storage development since 1990, storage densities should continue advancing at about 12 times the rate of processor performance (see Figure 2). By 2010, we expect hard disk storage on a typical PC will grow to between one and two terabytes (1 Tb = 1,024 Gb). By comparison, the current hard drive capacity on a typical entry-level desktop PC is 80 Gb.

Figure 2: Storage capacity and cost per Mb: 1995-2004



Source: Deloitte Research, 2004^v

Video game consoles are likely to see a significant increase in storage – since most current models have fairly low storage capacity – encouraging console makers to add value by incorporating digital audio and video recording features into their devices. Sony employed a similar strategy with its PlayStation 2, offering the ability to play DVDs at a time when dedicated DVD players were still beyond the price range of many households. The growing trend towards convergence of computing, networking and storage will enable console makers to offer multi-use devices that add value to their game platform – possibly supplanting other consumer electronics categories.

Falling storage prices will also encourage traditional consumer electronics manufacturers to integrate game capabilities into a wide variety of consumer products such as set-top boxes, DVD players and digital video recorders (DVRs).

Chip-based memory

Random access memory (RAM) and solid-state storage are integrated circuits embedded in silicon – just like processors – and are therefore subject to the growth rate predicted by Moore's Law, roughly doubling in capacity every two years. In recent years, the market for solid-state memory cards – including CompactFlash, Memory Stick, Secure Digital and SmartMedia – has grown dramatically in response to consumer demand for devices such as digital cameras and MP3 players.

Advances in solid-state memory will have a major impact on the handheld and mobile game markets, for two reasons. First, they will enable the development of more sophisticated and compelling games – with improved intelligence and better graphics. Second, they will allow mobile devices to have larger data caches that can partially compensate for low bandwidth and inconsistent connections in real-time wireless game playing.

Connectivity

Fixed line connectivity

By 2010, we estimate nearly 450 million homes around the world will have broadband connectivity at a speed of over 1 Mbit/s (see Figure 3). However, based on past experience, there will continue to be significant variations in speed and penetration from region to region. Figures 4 and 5 shows the wide range of broadband speeds available globally in 2003. That wide variation will affect the development of online games, forcing programmers to choose a nominal connection speed to design their games around.

The growing number of broadband-connected homes will help the electronic game industry in a variety of ways: Promoting the emerging genre of on-line games. Enhancing the value of existing standalone titles by enabling multiplayer options. Creating new revenue streams and business models based on on-line game subscriptions and pre-pay credits. And giving game publishers an alternate channel for sales and distribution.

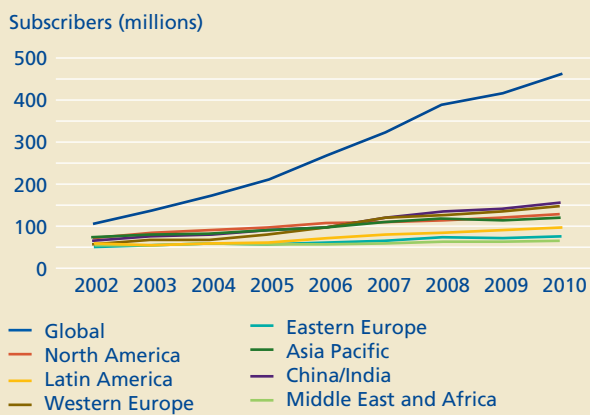
Wireless connectivity

By 2010, we expect there will be more than 2 billion mobile phones in use. These will operate on a range of network technologies, including current 2G (second generation), interim 2.5G, as well as 3G (third generation). By 2010, the majority of mobile operators will have launched a 3G network.

Any phone 2.5G or higher is significant from an electronic games perspective. 2.5G networks provide enough bandwidth – at least 20 Kbit/s – to purchase and download simple games. Phones based on 2.5G also generally support rich and polyphonic sound – prerequisites for current games. 3G networks support download speeds in excess of 100Kbit/s – making it possible to download games that are even more complex and compelling.

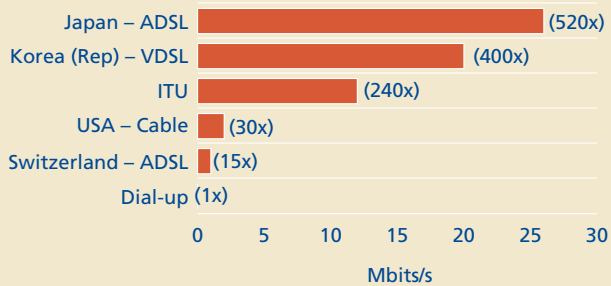
Of the 2 billion mobile subscribers in 2010, at least half will have handsets that support downloadable games. That is a potential market of 1 billion customers. At the same time, mobile phone technology will have advanced significantly – with high-end units featuring processors, screen resolutions and sound quality far superior to anything available today. Other wireless technologies will also have evolved and expanded, including Bluetooth – a short range wireless technology that enables multi-player games between people within ten meters of each other.

Figure 3: Broadband connectivity to households, 2001-2010



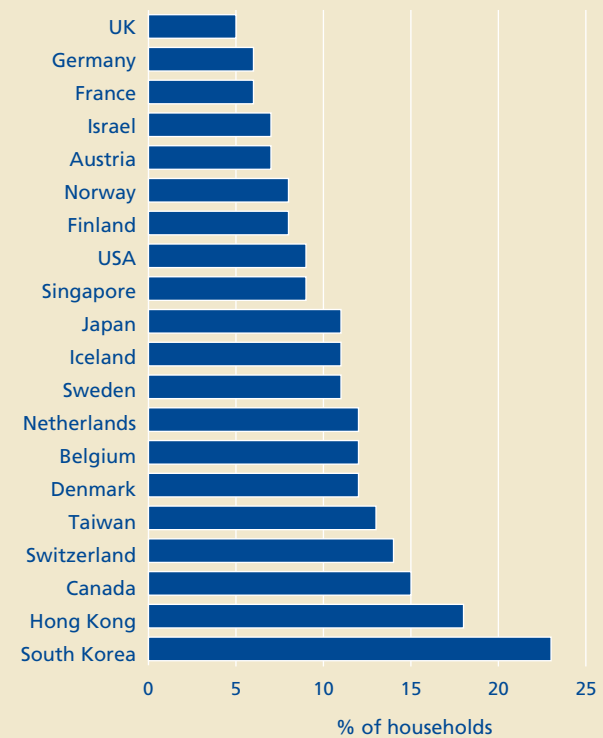
Source: Deloitte Research, Ovum, 2004

Figure 4: Comparison of broadband access speeds, July 2003



Source: ITU, 2003

Figure 5: Broadband population penetration, Q4 2003, top 20 countries worldwide



Source: Point Topic, 2004

4. Industry implications

The relentless advance of technologies at the heart of electronic games will have a significant impact on a far broader range of industries than those currently within the sector. It will blur the lines between product categories, threaten established companies, and drive development of entirely new products and services.

This section examines the impact of electronic game on individual industries – from consumer electronics and software publishing to entertainment, advertising and traditional toy manufacturers.

Implications for home console manufacturers

Summary

The biggest battles for electronic games will take place in the living room – and not just on the TV screen. Competition among video game console makers is already fierce and the stakes are getting higher. Sony and Microsoft are spending billions in an arms race to develop the next generation of video game consoles. The goal? Not just dominance in the lucrative game market, but even more important, the pole position in a race toward digital convergence that is occurring in living rooms around the world.

The battle for the living room

After years of hype and speculation, digital technologies are finally converging in the living room. Today, we have digital televisions and flat panel monitors. Digital video recorders with built-in hard drives. PCs that can play and record DVDs. Broadband connections over television cables. Standalone DVD recorders. And digital media receivers that can play MP3s and streaming video over a home network.

Video game console manufacturers, particularly Sony and Microsoft, are placing huge bets that the next generation video game console – with its massive processing power, high-capacity storage and broadband connectivity – will occupy the dominant position in the living room of the future. Giving the leading company the kind of market power that Microsoft currently enjoys in the PC business.

Other companies are entering the battle from their own positions of strength. Consumer electronic manufacturers are enhancing their products to include features from other product categories (for example, DVD recorders with built-in hard drives). PC companies are designing computers that can serve as digital entertainment centers as well as play games. And cable and satellite providers are embedding rudimentary game-platform technologies into their set-top boxes and on-demand services.

Few will stand the heat

During the cold war, most advances in chip design and computer architecture were the result of huge investments by military and aerospace contractors – with taxpayers picking up the tab. But today, the fastest computer processors are being developed for the consumer market – and the fastest of these are being designed for game consoles – with console makers absorbing the brunt of development costs instead of piggy-backing on technology developments from other industries.

Microsoft, Nintendo and Sony are currently locked in an “arms race” at the forefront of integrated circuit (IC) design – trying to develop the quantum leap in computing power and graphics that gamers have come to expect with each new generation of console technology. (See sidebar below: **Powering the next generation PlayStation**). Given the massive investment required, it is unlikely more than two will survive.

The price of admission is largely determined by Rock's Law, which predicts that the cost of building a semiconductor fab will double every four years. If Rock's Law holds true, by 2011 – the possible launch date for PlayStation 4 and Xbox 3 – a fabrication plant will cost nearly \$12 billion, twice the \$6 billion it will cost in 2007^{vi}.

For the PlayStation 3 chipset, Sony and Toshiba were forced to enlist IBM's help to develop and manufacture the highly-advanced core processor. That collaboration will significantly increase Sony's costs over the life of the product – and dilute its profit potential – but the company had no choice.

Powering the next generation PlayStation

Sony's PlayStation 2 represented a sizeable increase in performance and capabilities over the original PlayStation. Processor speed increased from 33.9 MHz to 294 MHz, an improvement of more than 850%. Even more important, PlayStation 2's 128 bit architecture produced a quantum leap in graphics performance (75 million polygons per second versus 360,000^{vii}) compared to the original PlayStation's 32 bit RISC chip.

For the PlayStation 3, Sony is aiming for 1,000% more processing power. The new chip, which could enter production as early as 2005, will be based on a distributed computing design capable of more than 1 trillion calculations per second. That would be roughly 100 times the power of today's 2.6 GHz Pentium 4^{viii}.



The fine print

Any company that chooses to compete in the home entertainment market will have to factor intellectual property issues into its cost structure. Giving consumers all the freedom they want to copy, save and distribute digital content will result in prolonged and costly legal, legislative and regulatory battles with the entertainment industry and other content providers. Software publishers will also be less inclined to create products for consoles that fail to prevent copying of their products. On the other hand, companies that concede too much to content providers and build rigid digital rights management into their products will lose consumer favor and market share to less restrictive designs.

Implications for electronic game publishers

Summary

As the electronic game market grows, it will become increasingly stratified. At the high-end, advances in hardware technology will up the ante for software publishers – creating demand for games that are deeper, more sophisticated and much more costly to produce. Those steep entry requirements will drive many smaller publishers away from the high-end console and PC markets. At the same time, industry expansion will create new opportunities in other segments – with technology developments creating a more compelling game experience for mobile phones, PDAs and other portable game devices.

Game publishers will look for ways to eke out every last bit of profit – releasing games on multiple platforms to leverage their investments and relying on sequels to reduce risk. Many games will feature on-line play to enhance the product's appeal and as a potential source of subscription revenue.

Moore's Law and electronic games

How technology advances will take electronic games everywhere

The industry will become heterogeneous

Technology advances through 2010 will make the game industry more complex, creating many more publisher categories. Advances in processors and storage will make high-end games for PCs and consoles more compelling, but they will also improve the appeal of games on other form factors such as mobile phones.

Technology raises the table stakes

Technology advancement is a double-edged sword. It offers the potential for revenue uplift, but also pushes up the cost of game development. With the emergence of each new platform, game publishers have to invest in familiarizing designers with the new machine's capabilities and development challenges. This can take several years, raising cost and risk – and disrupting cash flow. Greater storage capacity also means games can be longer – pushing development costs even higher. Overall, we expect development budgets for leading titles on next generation consoles and equivalent PCs to be an order of magnitude higher than for current platforms – well into the tens of millions of dollars.

Given the cost and complexity, existing publishers may opt out of the high-end game market. Developing games for simpler form factors such as mobile phones which are significantly faster and cheaper – although the potential pay-off is far lower as well. Analyst forecasts put the worldwide market for mobile games at \$7 billion by 2005,* compared with 2002 revenue of more than \$10 billion for console and PC games in the US alone.

Ports and sequels

As technological advances enable other consumer electronics devices to become game platforms, existing titles will be ported to those platforms, producing additional revenue streams with relatively low development costs. Many popular titles have already been ported to mobile phones, including arcade classics like **Space Invaders** and **Pac Man***, console hits such as **Lara Croft** and **Splinter Cell**, and even online legends like **Doom**®. Japan is currently the leading market for mobile phone games with revenues of \$180 millionⁱⁱⁱ.

New game consoles provide another opportunity for reuse – enhancing existing titles with vastly superior technology. PlayStation 2 prompted a stream of such games and the same will happen with PlayStation 3 and Xbox 2.

For publishers, the upside of multiple platforms is multiple channels for each game title. But exploiting new channels will require discrete investments in each platform. While a game's basic theme will apply for all platforms, the different underlying technologies will have a direct influence on the available functionality.



Another way for publishers to leverage their investments and reduce risk is by producing sequels. As in the movie industry, sequels allow a publisher to squeeze more value from a proven brand franchise.

Players go online

Online service models can provide game publishers with a new and appealing source of cash flow. The typical revenue model for networked multiplayer games assumes an annual subscription price of more than \$100, far higher than the price of a standalone game. However, if publishers are to move into a subscription-based revenue model, they will need a new array of server features, including hosting, billing and credit checking. Online service models based on pre-paid credits will have their own unique infrastructure requirements.

The push for cost optimization

Publishers serving all sectors will aim to reduce production costs. The industry will use new technology to improve their development processes and will follow the computer industry's lead in using off-shore labor for less creative tasks such as testing and debugging.

Software tools such as Criterion's RenderWare will increasingly be used to accelerate development cycles. Those products include standard components that can simply be dropped into a game program to provide commonly needed functions – for example, making an on-screen character run or jump – thereby reducing the amount of programming that must be done from scratch.

Implications for the advertising industry

Summary

Escalating development costs for electronic games – and an expanding audience with appealing demographics – will create new opportunities for advertisers. Game publishers looking to recoup their skyrocketing development costs will be increasingly receptive to the idea of building product advertising into their games. Meanwhile, technology improvements – including better screen resolution and seamless integration of advertised products into games – will help make product ads more appealing. One popular simulation game, **Sims Online**, already incorporates paid advertising into the actual game play.

Game publishers need advertisers

The growing cost of creating electronic games, particularly for consoles and PCs, will push the industry to find new sources of income. Improved technology will enable more realistic and appealing product placement within the actual game play, and network connectivity will allow product advertising to be localized. Broadband connections will enable publishers to change ads after the game is purchased – creating opportunities for publishers to sell timed advertising contracts and for advertisers to update their embedded ads.

Following the eyeballs from broadcast television to electronic games

Electronic games are capturing an increasing share of consumer time at the expense of traditional media, such as television. The advertising industry is increasingly interested in reaching electronic game players because of their maturing profile and the many hours they spend playing games.

Ads embedded in games will enable advertisers to stay in touch with consumers irrespective of shifting trends in media consumption – and the exposure an embedded ad can receive is significant. A PC-based role playing game such as **Morrowind** can take more than 200 hours to complete, while even a fast-paced game like **Unreal 2** typically requires at least 10 hours. Aggregating eyeball hours for a hit game (selling between three to five million copies) implies at least 50 million hours of viewing time. There are few television events that can match this kind of exposure. For specific games genres, there are further compelling reasons for product placement. US fans of driving video games have an unusually high propensity to own three cars or more.^{xiii}

Currently the cost of advertising in games is considered low, with \$100,000 being a standard fee. This is significantly less than television- or movie-based product placement, with the latter costing as much as tens of millions of dollars.

Major name companies which have advertised within games are drawn from a wide range of sectors including: automotive (Ford, Honda, General Motors), consumer goods (Krispy Kreme, McDonalds, Procter and Gamble, Red Bull), and apparel (Nike, Adidas, Puma, Skechers).

In some cases, games have even allowed companies to enter new markets. For example, the launch of Mitsubishi's Lancer Evo, a niche high-performance Japanese car, was driven by its inclusion in *Gran Turismo*, a driving game.^{xiv}

Your sponsors can improve your performance

The role of advertising within electronic games has changed radically over the past few years. After a period where advertising had been carried mostly for free, or at most for a five-figure fee, 2002 saw the first multimillion-dollar deal. The clients were McDonalds and Intel, and the game was **The Sims Online** – a network-based version of the hit game, **The Sims**, which sold 17 million copies. The most interesting aspect of the deal was the interactive advertising element. Characters within the game – which purports to simulate real-life – perform better when they eat at McDonalds or purchase PCs equipped with Pentium 4 processors^{xv}. While this kind of advertising might raise objections from some players, market economics will probably override their concerns.

Implications for Network Operators

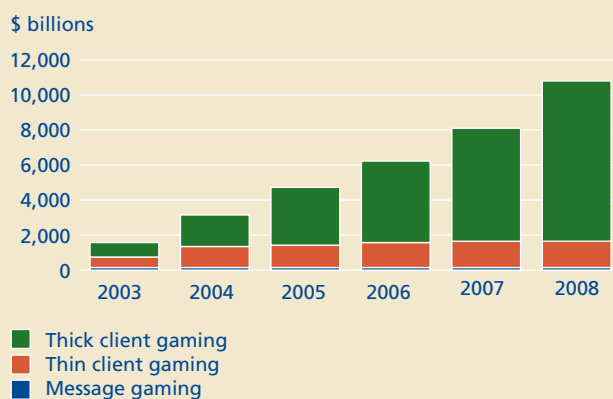
Summary

Electronic games will drive up demand for high-speed connectivity and wireless data services. Fixed-line operators will benefit from the increasing popularity of multi-player online games and downloadable game add-ons, which will fuel the adoption of broadband. Mobile operators will benefit by selling and distributing single-player games to their phone customers over the wireless network (see Figure 6), but mobile online games will present less of an opportunity due to network limitations.

Moore's Law and electronic games

How technology advances will take electronic games everywhere

Figure 6: Global revenues by wireless game segment (2003 – 2008)



Source: ITU, 2003

The fixed operator will become a channel for portions of games

The growing size of video game software will make it impractical to distribute entire high-end games over the fixed network, despite the widespread availability of broadband connections and improved transfer rates. Games will continue to get larger, driven by technological advances, with more powerful processors requiring more complex coding. Media for current game consoles and PC platforms can hold up to 4.7 Gb and next-generation DVD technology, which is likely to be used for video game storage, will offer up to 30 Gb capacity. These trends will favor continued physical distribution for high-end games.

Digital downloads will be the preferred medium for patches and game add-ons – for example, additional levels of play for platform games, new cars for racing games, updated team rosters for sports games, or even additional audio tracks. Sony Online Entertainment, a pioneer of digital game downloads, offered “The Legacy of Ykesha,” a minor expansion pack to **Everquest**, only as a download. Pre-orders, priced at \$18, numbered more than 200,000^{xvi}.

Online games over fixed networks will become mainstream

The proportion of console and PC game owners that play online is expected to increase steadily through 2010. Microsoft hopes to have one million customers for its subscription-based Xbox Live service by summer of 2004 – with other online game services pursuing similar goals.

Broadband penetration will fuel the growth of online games. High-speed connections make online games a lot more fun – eliminating network lag that can make a game difficult or impossible to play – and allowing designers to create games that are more compelling. Today, most games are still designed to accommodate dial-up connections (the lowest-common denominator). But as broadband becomes more pervasive, game designs will be improved to take full advantage of the higher speed and bandwidth – delivering a deeper and richer experience that consumers will find more appealing.

Conversely, the growth of online games will fuel the spread of broadband – both for first-time connections and service upgrades. Microsoft’s Xbox Live already requires a broadband connection and other online services are leaning in that direction. Even when it is not strictly required, more and more gamers will elect to go with broadband to take advantage of superior game play.

By 2010, we expect online games to be a sizeable but still relatively minor revenue stream for content developers and the communications industry. Industry analyst Jupiter Communications forecasts that the global online game industry will be a \$1.7 billion market in 2007. That figure is significant in absolute dollars, but is only a minor percentage of overall industry revenues, which were more than \$10 billion in 2002 in the US market alone^{xvii}. That said, a number of start-up companies are already enjoying considerable success in this market niche, including Chinese Gamer and Shanda Networking.

The mobile operator will become a channel for the electronic game

Mobile operators will be the dominant channel for mobile phone-based electronic games. The mobile phone and electronic game mesh well because both play and acquisition can take place anytime and anywhere.

The improving performance of packet-switched mobile networks will enable this trend. Current GPRS networks provide download speeds of up to 50Kbs. Actual transfer rates under typical conditions are closer to 20Kbs, but this still allows simple games – such as the Atari classic **Asteroids** – to be downloaded in under a minute. CDMA 1X, CDMA EVDO and W-CDMA networks will predominate by 2010 and all will provide much higher transfer rates (from 100Kbs to 500Kbs), allowing mobile consumers to purchase more complex games.

Users will select games from a portal on their phones. The game software will then be sent over the wireless network and charged to their monthly bill – or directly to a credit card. Today, this process is only possible for a minority^{xviii} of phones that allow over-the-air software downloads via a technology such as J2ME. But by 2010, we believe the vast majority of handsets will support the downloading of games. Only a small number of mobile phone games will be sold as discrete modules in retail stores^{xix}.

Customers are currently paying up to \$10 for the best mobile phone game. For games publishers this may represent a better return relative to developing for consoles. We believe that customers will be willing to pay more for a mobile phone game as their “game console” is always with them – enhancing the game's perceived value.

The revenue growth of G-mode, a Japanese mobile game content provider, shows the potential of cellular games. In 2003, the company ranked as the third-fastest growing company in the Technology, Media and Telecommunications Sector of the Deloitte Fast 500 – with three-year revenue growth of 5,264 percent. Figure 6 shows a forecast of mobile game revenue for 2003-2008.

The quality of mobile networks will be insufficient to support online games

We expect there will be attempts to introduce real-time online games for the mobile phone platform. However, the bandwidth available for mobile telephony will remain relatively poor throughout the forecast period. Network games for mobile phones will require careful design to ensure their appeal is not diminished by dropped connections – and the overall quality of the experience will probably not be high enough to support significant market penetration.

Implications for movie studios and television companies

Summary

Movie studios have long recognized the value of merchandising, and electronic games represent an important new merchandising category. Blockbuster movies already command game license fees of more than \$10 million – and that figure is rising rapidly. Software publishers are willing to pay those fees because the right license can dramatically improve a game's chances of success.

The line between movies and games continues to blur. Modern movies already incorporate extensive computer generated animation, and next generation game consoles are expected to deliver movie quality visuals. There is also extensive cross-over between the two mediums – with blockbuster movies inspiring games and best-selling games inspiring movies.

Electronic games are an increasingly important source of revenue for movie studios and television companies

To movie studios, which have long recognized the value of merchandising, electronic games provide yet another merchandising category – one that will spread across an increasing number of platforms through 2010.

The license fee charged for blockbuster films such as **Harry Potter**, **Spiderman** and **Lord of the Rings** has already exceeded \$10 million. Licensing the game rights to a popular film, especially one that is already a hit, greatly improves the chances of success. The first **Harry Potter** game sold more than 7 million copies in its first Christmas season – the most successful launch ever for industry giant Electronic Arts.

As game technology improves, we expect licensing revenues to continue growing, due in part to the expanding number of form factors on which games will be developed.

This could be the start of a beautiful friendship

Games and movies provide powerful marketing for each other. A popular game drives fans to theaters and video stores, while movie fans are very likely to buy a game based on a favorite movie. Game publishers and movie studios both profit from this relationship, yet the current balance of power appears tilted toward the studios – with game houses like Activision, THQ and Electronic Arts all opening offices near Hollywood.

Nevertheless, movie studios have not overlooked the potential to leverage the brand strength of video game characters. Movies such as **Tomb Raider** and **Mortal Kombat** are based on characters that first appeared in video games. And the BBC has developed a television series where participants assume the role of characters in a video game. As long as publishers continue to develop games with original and interesting characters, movie studios and television companies will keep looking to electronic games for ideas.

Technological advances will allow the symbiosis to grow even stronger. There is still a distinct difference in image quality between game-based video and movies in DVD or broadcast format, but the gap is closing fast. The next generation PlayStation 3 and Xbox 2 are expected to produce movie quality images, allowing game players to take on a convincingly realistic role in a movie.

The Matrix was initially conceived as both a movie and a game – with exclusive in-game film footage – a development model that may represent the wave of the future. Other games such as **The Lord of the Rings** incorporate actual footage from the movie.

Technological advances will allow games based on movies and TV to be offered on multiple platforms

Thus far, the majority of movie and television tie-ins have been created for dedicated video consoles and PCs. However, growing technological capabilities will allow tie-ins to be supported on an ever-expanding range of platforms.

Mobile phones are emerging as a particularly hot new market for TV and movie-based games. One revenue model offers downloadable games that are basically abbreviated versions of console titles. A second revenue model relies on network usage fees from player participation. For example, the popular game **Who Wants to be a Millionaire?** is played via Short Messaging Service (SMS), with users paying for the game through standard message charges. Although the technology is simple – SMS is text-only and supports only 160 characters – it is adequate for question-and-answer games. Mobile messaging will grow in complexity as users start to adopt multimedia message (MMS) formats. This in turn will create the potential for increasing revenue as MMS adoption grows.

Implications for Music Companies

Summary

Music in games has come a long way from the simple beeps of **Pong** and **Pac Man**. Today, music is an essential part of the game experience – and an increasingly important differentiator. Most PC and console games feature CD-quality music, either created specifically for the game or licensed from established music companies. In some cases, that music has even been marketed as a standalone product – much like a movie soundtrack – with the game serving as the primary marketing channel. There are also games where music is the central focus – with players using the game software to create music or dance competitively. Music plays less of a role in mobile phones and other handheld devices, but that is sure to change as the technology improves.

Electronic games will provide significant revenue for music companies

As publishers increasingly use music as a differentiator, electronic games will become a significant source of music licensing revenue. Music revenues will be highest where the audio quality is best, primarily on dedicated consoles and PCs, but music will increasingly be featured on games for handheld devices and other form factors.

Music already plays a major part in video games. One of 2002's best-selling titles, **Grand Theft Auto: Vice City**, contained enough music to fill seven audio CDs*, all of which were available for sale as standalone products. Another leading title, **Final Fantasy**, features original compositions in the majority of its 10 chapters. Music from the most popular game soundtracks is available in a variety of forms, including traditional soundtrack albums, greatest hit compilations, piano-based interpretations and even sheet music. In some cases, additional music tracks can be downloaded from the publisher's web site – enhancing the game's appeal and extending its replay value.

Music is the game

Music can also form the basis for an electronic game – providing music companies with additional licensing opportunities. Games such as the **MTV Music Generator** focus on music competition. Other games require players to follow a dance pattern set to music, with dancer movements captured by a step-sensitive mat connected to the console or television. Dancing games were originally a hit in arcades, then moved to video consoles and are now available as standalone units.

Implications for traditional toy manufacturers

Summary

Electronic game companies and traditional toy manufacturers often find themselves competing for "play" share – particularly in the youth market. But ultimately that is a losing battle for both sides. Add-on accessories have always been a lucrative market for toy manufacturers, for all types of toys – from train sets to dolls. Technology progress will expand that market, enabling entirely new types of accessories, and will allow companies to improve the appeal of their mainstream toys by making them smarter and more interactive. Electronic games can also create opportunities for cross-licensing.

Technology progress can re-invent the traditional toy

Toy vendors must monitor the progress of electronic game technology, constantly looking for ways to improve their existing product portfolio. In most cases, the technology for mainstream toys will need to be significantly stripped-down, but it can still add value and extend the life cycle of a traditional toy.

For example, electronic game technology has been used to transform Lego from basic building blocks to programmable, interactive toys. "Smart bricks" enable Lego structures to produce a wide range of sound, light and movement – and to react to movement, light and other stimuli – opening up a whole new world of creations, from racecars and robots to automated factories and miniature amusement park rides.

Game technology can also be used to improve and differentiate the traditional doll. The Diva Starz, a top-selling toy at the start of the decade, featured an internal clock that triggered intelligent, pre-recorded sound bites in different situations. For instance, dressing a Diva with an evening gown too early in the day prompted the protest, "Girl, it is way too early for that dress."

Electronic game technology can also be used to enhance board games and soft toys – with artificial intelligence providing a deeper and more interactive toy experience.

At the high-end of the toy market, Sony's third-generation robotic dog, AIBO, includes an impressive array of cutting-edge technologies, including a video camera and wireless network card. AIBO – which retails for more than \$1,000 – is not exactly a mainstream product, but it does provide a good indicator of things to come.

Technology creates new revenue streams for toy manufacturers

Add-on accessories have always been a lucrative market for toy manufacturers, for all types of toys – from train sets to dolls. Technology progress will expand that market, enabling entirely new types of accessories.

The growing availability of broadband connections, along with improvements in memory cards and processor speed, will create a market for downloadable accessories. For example, the latest iteration of Sony's AIBO includes a Memory Stick that enables owners of the robotic dog to download new features, including voice commands, facial expressions and tricks.

Traditional toys can inspire video games

Video games have often been accused of competing with traditional toys. However toy makers should also consider the extent to which electronic games, even console-based games, can be a source of additional licensing revenue. There are many examples of traditional toys being reinvented as electronic games.

Mattel, one of the largest traditional toy manufacturers, took this approach with Rock 'em Sock 'em Robots. The original toy placed two plastic robots in a miniature ring where they "fought" by punching each other until one had its head knocked off. The electronic game, developed for PlayStation 2 and handheld consoles, recreates that same experience using virtual robots on a television screen.

5. Conclusions and recommendations

Electronic games are at the forefront of technology development, pushing – and being pushed by – the latest advances in technology. The market's seemingly endless demand for better and more sophisticated games is now one of the key driving forces behind cutting-edge development in processors, storage and connectivity. At the same time, continuous advances in those technologies fuel demand for games – making them more compelling, more sophisticated, more ubiquitous and ultimately more fun.

These dual forces are spurring disruptive change – not just for the electronic game industry, but also for an increasing number of industries that are touched by electronic games. As electronic games become ubiquitous, its influence will surely grow. What can companies do to capitalize on this trend – instead of being consumed by it?

Brace for impact. Electronic games used to be the exclusive domain of game publishers and console manufacturers, but it now presents challenges and opportunities for many other industries – from advertising and consumer electronics to music and movies. Executives in other industries must consider how electronic games will affect their companies – and take appropriate action.

Choose a niche. The biggest, most obvious business opportunities are not necessarily the best – especially if a company does not have the resources or market power to be successful. The proliferation of electronic games will create a wide range of opportunities, but technological advances and increased competition will up the ante – forcing executives to make tough choices about where to focus and in many cases requiring them to “bet the company” on the outcome.

Look ahead. The one sure bet is that technology is not going to stand still. On the positive side, technology advances will make games more realistic, more compelling and more accessible – on an increasing number of platforms and form factors. On the negative side, they will drive up development costs and provide developers with a moving target. To be successful, companies will need to stay on top of technological change, closely monitoring its progress and accurately predicting what it will allow them to do at specific points in the future.

Take the long-term view. Companies entering a fast-growing market like electronic games should expect volatility – and be willing to ride it out. Developing a new hardware platform or high-end game will require a significant investment sustained over several years. Companies unwilling to make that kind of commitment should invest their money elsewhere – or shift their focus to a less demanding niche.

Expect dramatic shifts. Although technology development is fairly predictable over the long-term, consumer demand and market dynamics are not. In the late 1970s and early 1980s, the console market experienced a spectacular boom-and-bust cycle. After the crash, the electronic game market continued to move forward – but in an entirely different form centered around PCs. Companies involved with electronic games can expect similarly dramatic shifts in the future and must be prepared to deal with them.

In less than a decade, the electronic game industry has transformed itself from an industry niche to a global powerhouse, and that trend is expected to continue through at least 2010. Driven by the relentless force of Moore's Law, electronic games and its related technologies will generate shock waves that extend far beyond the electronic gaming sector – blurring the lines between industries and encroaching on existing product categories. Early movers like Sony and Microsoft are already spending billions of dollars to position themselves for market leadership – and many others are about to enter the fray. It is a risky game, but the risk of inaction is even higher – as are the potential rewards.

Notes

- i Source: "PlayStation History", Sony Computer Entertainment, http://www.absolute-playstation.com/api_faqs/faq20.htm
- ii Source: <http://gameinfowire.com/news.asp?nid=33>
- iii Source <http://www.elspa.com/> "SALES OF VIDEO GAMES CONTINUE" 18th October 2002
- iv This ranking was based on Deloitte's Asia Pacific Fast 500 survey. This placed three gaming companies (Chinese Gamer, Shanda Networking and G-mode) as the fastest growing companies in the Asia Pacific technology sector, based on three years' revenues.
- v Source: <http://www.littletechshoppe.com/ns1625/winchest.html>
- vi *ibid*
- vii Source: "From Exuberant Youth to Sustainable Maturity: Competitive Analysis of the UK Games Software Sector", Department of Trade and Industry / Spectrum, 2002
- viii Source: "PlayStation 3 chip nears completion", Tuesday 6th August 2002, <http://news.zdnet.co.uk/story/0,,t269-s2120395,00.html>
- ix According to Strategy Analytics, by 2008, Wireless games will generate revenues in excess of \$7 Billion, with downloadable Java and BREW games both offering the greatest potential for growth. The emphasis on browser-based games and text games will fade from the games developer community and consumers horizons, as users become seduced by branded downloadable games that are available for their multimedia handsets. Source: Strategy Analytics Press Release, April 2003
- x Atari is re-releasing many of its classic arcade games for distribution to mobile phones; Taito, the Japanese creator of Space Invaders, has signed deals with 30 mobile operators around the world for the release of mobile phone versions of its classic titles, which also include Bubble Bob and Qiz; Sega has set up a specific division, Sega Mobile, whose output includes an n-Gage version of its perennial favorite: Sonic the Hedgehog.
- xi Source: "Battle for the heart of the handset, BBC Online, 20 October 2002
- xii Source: "Space Invaders lead attack on mobile phones", Financial Times, 31 October 2003
- xiii Source: "Advertisers Target Videogames", Forbes, March 26th, 2001
- xiv Source: "Video games open new path to market cars", Detroit News, February 15th, 2004
- xv Source: "Gunning for Gamer", The Guardian, September 30, 2002
- xvi Source: Sony's Cash Machine, CNN, 12 February 2003
http://money.cnn.com/2003/02/11/commentary/game_over/column_gaming/
- xvii Source : "Gaming comes of age", BBC Online, 17 December, 2002, <http://news.bbc.co.uk/1/hi/technology/2583697.stm>
- xviii Penetration of J2ME and its equivalents was in the region of 10% as of Q3 2003.
- xix Nokia's n-gage product, aimed at games players and due for launch in the first quarter of 2003, is based around plug-in modules, rather than over-the-air downloads. The device's cellular mobile capability is to allow remote multi-player games, as well as to make calls. For more information, see <http://www.n-gage.com/n-gage/news.html#1>
- xx According to the press release, "the radio stations in Grand Theft Auto: Vice City will feature the largest selection of music ever assembled for a video game with over eighty staggering tracks from artists such as Judas Priest, Blondie, Flock of Seagulls, Kool and the Gang, Hall and Oates, Grandmaster Flash, Cutting Crew and many, many more that span the entire musical spectrum of the period." Source: <http://www.gamefaction.com/news/103158529162075.shtml>

Moore's Law and electronic games

How technology advance will take electronic games everywhere

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