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POSTMORTEM: FINAL FANTASY XIII

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POSTMORTEM

24 SQUARE ENIX'S FINAL FANTASY XIII

When development started on FINAL FANTASY XIII its gameplay, scenario, and technical specs were only vaguely defined. But this didn't stop the team from motoring ahead anyway, creating assets at an ever increasing pace with no clear sense as to whether they would even be usable in the game. It wasn't until the team was obligated to create a playable demo for the Japanese market that the title's ultimate design came into focus. In this postmortem we get a unique look at the creation of a game whose epic scope almost got the better of the studio. *By Motomu Toriyama and Akihiko Maeda*

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7 COMPANIES TO WATCH

The game industry is a constantly shifting landscape. What companies should you be watching to see which way the wind is blowing? Here *Game Developer* looks at 20 companies that currently or have the potential to set the course for the industry's future. *By Jeffrey Fleming and Brandon Sheffield*

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In this companion piece to *Game Developer*'s "Companies To Watch," we look at the publishers that are having the biggest influence over the direction of the game industry. *By Brandon Sheffield*

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PORTAL was one of those rare, perfectly encapsulated experiences where gameplay and aesthetics were in complete harmony. So how does one go about creating a sequel without disrupting the elegant balance of the original? According to PORTAL 2 project manager Erik Johnson, keeping players surprised is the key. *By Brandon Sheffield*

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WAL-MART VERSUS THE MOM AND POPS

DO WHAT YOU DO BEST

AS I WRITE THIS, I'M IN JAPAN FOR the Tokyo Game Show, and as such I've had the opportunity to speak with a number of Japanese developers in the last few days. One question on everyone's lips is "how do we appeal to the Western market?" It's understandable—the Western market is huge, and the hardcore HD gamer in Japan is becoming less and less common.

Though this is anecdotal rather than empirical, I would submit that part of the reason Japanese hardcore gamers are on the decline is that while Western gamers grew up loving games, and have continued to find them a viable means of entertainment, Japanese gamers that grew up with the NES/Famicom now find those old games to be "nostalgic," but have moved on to other leisure activities. However, on this side of the pond we've stuck with games well into our adulthood.

WAL-MART: THE GREAT EVIL

>> In one particular discussion, I mentioned that Japanese game companies needn't hide their cultural background and different nature when making games for the West, as they often try to. It's similar to the debate about Wal-Mart killing all the local businesses. The fact is, yes, Wal-Mart kills local grocers, clothiers, and appliance shops when it moves into an area. It does this by providing a greater variety of products at a cheaper or comparable price, all in one location. The trouble is, if your market is general, like many of these mom and pop stores, someone will always be able to do that better than you, faster than you, and more efficiently than you, provided they have the backing to do it.

While I absolutely do feel for the mom and pop shops that got closed down when Wal-Mart rolled in with its poor wages and sub-par product, I understand why people choose convenience over the principle of supporting local business. People will always do what's easier for them.

But then, there are the niches. If you want to get the right kind of bait or tackle or fishing rod, you're not going to go to Wal-Mart, you're going to go to a specialty bait shop. If you're into model trains, you're going to go to a shop that specializes in that. If you like comic books, you're definitely not going to be sifting through the romance novels at Wal-Mart to try to find the latest James Kochalka zine.

What Wal-Mart can't do is cater to specific tastes. If what you're doing is very generalized, someone will always be able to do it better. But if you're a specialist, by definition you're equipped to understand that niche better than Wal-Mart could ever hope to, or even desire to. Wal-Mart doesn't want to be the best seller of model trains. Wal-Mart wants to make the most money with the least effort. If you love trains, you've got a niche you can fill, with the right amount of skill and exposure.

GET IN THE NICHE

>> There are two types of Japanese games that have done well in recent years. There are those games that are simply very solid, but don't necessarily appear to be from any particular country. Games like STREET FIGHTER IV or NEW SUPER MARIO BROS. WII are good examples. But you've also got the games with interesting ideas that attempt to differentiate themselves in order to get noticed, such as NO MORE HEROES or DEMON'S SOULS. The games from Japan that have failed have often been those that attempted to emulate Western games just for the sake of it, without actually understanding what makes those games fun in the first place.

This really applies to all of game development, not just when trying to make a game in Japan that will appeal to the West—but you've got to have a basically good game above all other things. Just keep in mind, if you go into the generalist camp, simply trying to make a good game with common themes, you're competing with a huge number of companies, many of which will have been toiling in your particular genre, with your particular brand of space marine for many a year.

On the other hand, if you spend more time working to differentiate your game, to give it a unique visual, aural, or game play style (and I mean significantly different, not just nicer explosions, or better ponytail physics), then you've got a talking point right away. The press will want to pay attention to your title, because maybe it's doing something interesting. Fans will notice the press and follow the title. Non-core gamers may even catch wind of this buzz, if it gets loud enough.

Could a Japanese-developed third-person shooter about a bald, no-nonsense space marine work? Certainly it could. But does simply emulating that idea show the strength of a company or an understanding of a genre? Not really. On the other hand, with an interesting visual theme and an irreverent sense of humor, you immediately wind up closer to distinctive games like NO MORE HEROES or METAL GEAR SOLID.

It's not necessary to hide where you come from—an American game developer making RED DEAD REDEMPTION is a perfect fit. A British game developer like TT Games making an irreverent well-animated action platformer like the LEGO franchise is a perfect fit. For Japan, making a rather heady, visually stylish game such as MAD WORLD or BAYONETTA makes the most sense. Why should we try to be something we're not? If we all just take what we know, apply the existing techniques from other games that have come before us, but marry all that with our unique expertise, then we wind up being the invincible mom and pop that Wal-Mart simply can't touch.

—Brandon Sheffield

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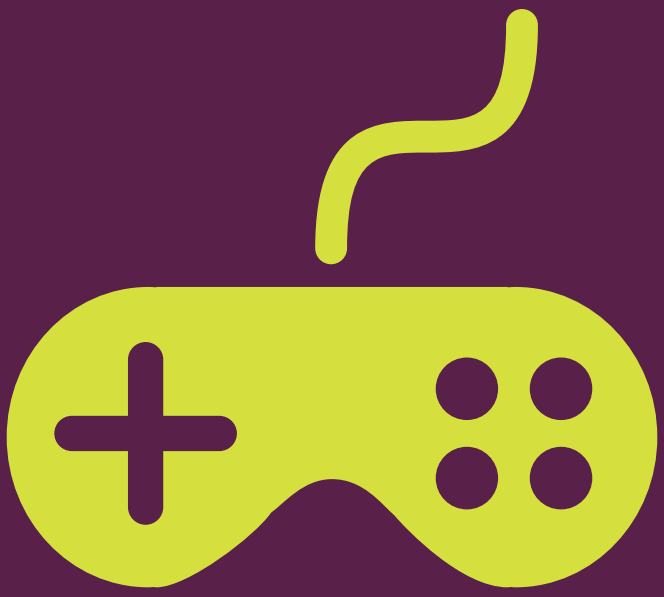

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Sources: Arab Media Outlook 2010. Media on the Move 2009. A.T. Kearney. Introduction to Gaming. Michael Moore. Screen Digest. IDC.

FILM REVIEW

RICHARD GARRIOTT MAN ON A MISSION

IN OCTOBER 2008, RICHARD Garriott, famed Ultima designer, Origin Systems founder, ex-NCsoft designer, and now Portalarium cofounder, spent 10 days on board the International Space Station. One might be tempted to dismiss Garriott's $30 million ride on a Russian Soyuz rocket to the ISS as a rich man's indulgence if it weren't for his sincere efforts at sharing the experience. Now, with the release of the new documentary *Richard Garriott: Man on a Mission*, viewers can join Garriott on that journey to a little-seen world where men and women are working at the very edge of human experience.

The multimillion-dollar deal to carry Garriott to the ISS was brokered by Space Adventures and to this day, the company has helped launch seven private citizens on the Soyuz spacecraft. Garriott sits on the board of directors for Space Adventures and his father Owen Garriott, a veteran astronaut who flew on Skylab and Shuttle missions, is on the company's advisory board. It is perhaps because of this business connection that the opening segments of *Man on a Mission* have the slightly awkward tone of a corporate pitch video as it describes space tourism and introduces Garriott to an audience who may not be aware of his history in the game industry. However, once the camera follows Garriott to Star City in Russia as he trains for his flight, the film's real power is revealed and we get a surprisingly candid look at the Russian space program.

Directed by Mike Woolf and produced by Brady Dial, with handheld camera work from Garriott himself, *Man on a Mission* benefits greatly from Garriott's status as a knowledgeable and competent but ultimately non-essential "spaceflight participant." His outsider perspective affords the filmmakers an astonishing range of access to the Russian space program, allowing them the freedom to document both the mundane and the majestic with equal clarity.

Those who are old enough to remember the Cold War and the resulting secrecy that surrounded Russian space exploration will be amazed to see Star City revealed, not as a sinister Black Mesa-like complex, but as it really is: a green and pleasant campus. At Star City, we also witness some of the comforting rituals that surround cosmonauts who are preparing to go to space. As they lay flowers at the grave of the first man in space Yuri Gagarin and plant a tree in Star City before leaving, we get a sense that the Russians have an awareness of the spiritual dimensions of space travel—something that is rarely acknowledged in the technology-fixated West.

The Soyuz liftoff from the Baikonur Cosmodrome in Kazakhstan is quite different from NASA's tightly controlled operations. As astronaut Mike Finke, cosmonaut Yuri Lonchakov, and Garriott wave goodbye, a large crowd of well-wishers gathers around the rocket engines to see them board (a scenario that would never be permitted during a shuttle launch). Although the Russians may have a reputation for doing things on the cheap side (NASA pegs the average cost of a single shuttle flight at $450 million while a Soyuz launch is estimated to cost less than $50 million), it should be remembered that they have a far better safety record than does the Space Shuttle.

Garriott, Finke, and Lonchakov prepare to board the Soyuz spacecraft.

Throughout *Man on a Mission*, it is the small details that Garriott captures with a handheld camera that prove most fascinating. On the approach to the ISS, an orbit-correcting rocket burn produces a sudden and alarming jolt in the Soyuz's tiny cabin. Along the way, we get intriguing glimpses at the capsule's computer monitors glowing amber and densely packed with Cyrillic data.

Inside the ISS, we find the architecture confusing and Escher-like; it's a place where the concepts of floor and ceiling no longer have any meaning. The station's close, intimate environment has the cluttered functionality of an intensive care unit, quite different from the imaginings of science fiction. A window shutter opens to reveal a ravishing view of the Earth's upper atmosphere rushing below in a wide arc as sunlight glints off the station's solar panels. Throughout all the footage is the background noise of air circulators, a constant reminder of the hard vacuum just outside.

Perhaps the most startling images are during Garriott's return to Earth. Glowing streams of superheated plasma roar past the capsule's viewport during reentry, filling the cabin with a flickering orange light while its three passengers are violently shaken about. Here we have what may be the first publicly seen footage of an atmospheric reentry; it's a powerful experience that must be frightening to even the most experienced astronaut.

Once on the ground, Garriott and the two returning cosmonauts, Sergey Volkov and Oleg Kononenko, have the appearance of national heroes, glorious in their Sokol flight suits as they are pulled from the Soyuz capsule. While Garriott may not be making quite the same contribution to human progress as the cosmonauts and astronauts whose company he shares, in his own way, Garriott is helping bring us all a little closer to making that next great leap.

—Jeffrey Fleming

ASSEMBLY 2010

ASSEMBLY IS ONE OF EUROPE'S BIGGEST AND most prestigious annual events for demoscene enthusiasts and gamers. Assembly has come a long way since its first school hall meeting in 1992, with this past August's four-day event occupying a huge ice hockey arena in Helsinki, Finland. It now attracts over 5,000 visitors each year, and broadcasts its own TV channel live over the Internet and Finnish cable TV.

In the pre-Internet 1980s and 1990s, parties were the main way for demosceners to get together. Today, even when the community can easily communicate through email, Internet Relay Chat, and dedicated forums, demoscene parties are still an immensely popular place for demosceners from across the world to gather together, swap stories and, most importantly, release their new demos.

To that end, for four days in early August each year, the center of Hartwall Arena is transformed into a giant LAN party with space for 3,000 computers. A big screen at one end shows live COUNTER-STRIKE and other gaming competitions, and later in the program, the same screen is used to show demoscene competitions.

Although it is traditionally a demoscene party, the vast majority of visitors to Assembly are now there for the gaming. Gaming is now such a huge part of Assembly that, starting in 2007, they have also been running a successful gamer-only event called "Assembly Winter" held each January.

While this may seem at odds with the demoscene ethos, it is the organizers' embracing of gamer groups as well as their continued understanding and commitment to the demoscene that keeps this event at the forefront of the modern demoscene. It helps that the main organizers, Pekka "Pehu" Aakko and Jussi "Abyss" Laakkonen, were involved with legendary Finnish demoscene groups Accession and Future Crew back in the 1980s and 1990s.

Assembly's success is also due to the social nature of the event. As well as the demoscene and gaming competitions, there are also outdoor events such as the traditional disk and CD throwing challenges, and new this year, Nokia-sponsored N900 throwing event. The normal sports of soccer and street basketball also help to get people out into the open air and socializing.

The main demoscene attraction is the high-profile and prestigious PC Demo competition, in which groups compete to produce the best real-time audio/visual demonstrations—think of them as real-time versions of music or motion graphic videos. There are also 64k and 4k Demo competitions that impose strict limits upon the entrants, forcing them to pack the code and data that generates the audio and video into 65,536 or 4,096 byte executables respectively. These three competitions also command the biggest prize—the main PC Demo competition rewards its winner with 7,000 Euros.

In addition to these headline competitions, Assembly also provides an outlet for the lower-profile productions, such as Oldschool demos (a demo produced on any readily available system that was produced before 1992), Short Films, and Real Wilds. This last category allows entries on any platform that can produce real time-sound and video that is not already covered by the other categories; this year, the competition was won by a Flash entry, but it also included mobile phone and JavaScript demos. Assembly also hosts a gamedev competition which attracted 19 entries this year. The competition was won by the excellent physics-based driving game TRICKY TRUCK. Finally, there are also competitions for music and static graphics.

Assembly also boasts an impressive ARTtech seminar track. In previous years, there have been talks given by such game industry luminaries as LucasArts' David Fox and Llamasoft's Jeff Minter. This year, sessions included a tech talk by Saku Lehtinen of Remedy Entertainment as well as discussions on freedom and privacy by John Buckman, chairman of the Electronic Frontier Foundation, and Peter Sunde Kolmisoppi, cofounder of The Pirate Bay. On the demoscene front, there were tech talks from Konstantinos Pataridis of ASD and Matt Swoboda of Fairlight, who both treated us to previews of what turned out to be the first and second place entries in the main PC Demo competition.

You can see and hear all of the demos, songs, and images from Assembly 2010's demoscene competitions on the organization's main site at www.assembly.org/summer10/gallery. You can also locate and download all of the executables from the demoscene portal Pouet at www.pouet.net/party.php?which=7=2010.

Assembly is held every August at the Hartwall Arena in Helsinki. Although many visitors choose to sleep in the venue itself, there are also high-quality hotels within walking distance. People of all nationalities attend the event, and English is spoken widely and fluently across Finland. See you there in 2011!

—Paul Grenfell

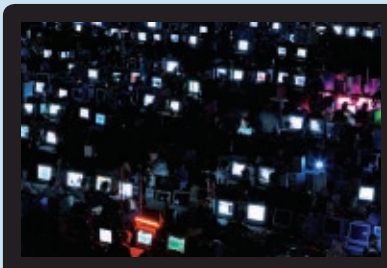

PHOTO BY PEKKA AAKKO

ASSEMBLY 2010 COMPETITION RESULTS

PC DEMO
1. Happiness Is Around The Bend by Andromeda Software Development
2. Ceasefire (all fall down..) by CNCD vs Fairlight
3. Abysmal Invaders by Pyrotech

64K INTRO
1. X Marks The Spot by portal process
2. Behind the Curtain by United Force vs. Digital Dynamite
3. Ars Nova by Phantom Lord/Accept Corp.

4K INTRO
1. Neanderstaller by Pittsburgh Stallers
2. Atleeti by Archee
3. Bubblin Under by adapt

GAMEDEV
1. TRICKY TRUCK by Archee
2. 7-BIT PIRATES by The 7 bits
3. PART-TIME ANGLE GRINDER HERO by Tekotuotanto

IGDA ELECTS NEW VP AND SECRETARY

The International Game Developers Association announced that it has elected a new vice president and secretary to its board of directors.

The new vice president is Jane Pinckard, who has experience as a member of the press, a Game Developers Conference manager, and a business developer for Foundation 9 Entertainment.

Pinckard will serve as vice president for six months, until the next chair election in spring 2011, after which the position will once again be vacated.

Darius Kazemi will take on the role of secretary, replacing Brian Robbins, who became the chair of the Board last week.

Kazemi currently serves as president of game play metrics company Orbus Gameworks, and has experience working at Turbine, Inc. *—Tom Curtis*

15 OF THE WORLD'S TOP 20 PUBLISHERS

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20 companies to watch

WHILE THE CURRENT GENERATION OF GAME CONSOLES MAY HAVE SETTLED INTO A COMFORTABLE TECHNOLOGICAL MIDDLE AGE (SEE THIS MONTH'S PIXEL PUSHER FOR AN ARTIST'S PERSPECTIVE) THE INDUSTRY AS A WHOLE CONTINUES TO SAIL THROUGH UNCHARTED WATERS ROLLING WITH INTRIGUE AND UNCERTAINTY. THE PROMISE OF DIGITAL DISTRIBUTION IS GAINING CURRENCY EVERYDAY AND THE GROWING POPULARITY OF CASUAL AND SOCIAL GAMING COULD COMPLETELY REDEFINE WHAT CONSTITUTES A VIDEO GAME. THE GAMING AUDIENCE'S TASTE IS RAPIDLY CHANGING TOO. DIVERSITY AND AGE ARE BECOMING REAL FACTORS TO CONSIDER WHEN DESIGNING GAMES AS THE INDUSTRY TRANSITIONS FROM BEING ALL THINGS TO SOME PEOPLE TO BEING SOME THINGS TO MANY PEOPLE.

HERE THEN IS *GAME DEVELOPER*'S LIST OF COMPANIES THAT ARE OUT IN FRONT OF THE CHANGES SWEEPING THROUGH THE GAME INDUSTRY. THESE ARE THE BELLWETHERS AND THOSE WANTING TO TAKE THE MEASURE OF THE INDUSTRY SHOULD WATCH THEM CLOSELY. HOW THEY FARE OVER THE NEXT MONTHS AND YEARS WILL REVEAL A LOT ABOUT WHERE WE ARE AT AND WHERE WE ARE GOING AS A 21ST CENTURY ENTERTAINMENT MEDIUM.

Danger Close Games

:: It's a rare thing to see a top-tier studio within one of the world's largest publicly traded game publishing companies step so confidently into the breach with a game that is guaranteed to stir up controversy. How appropriate then that the MEDAL OF HONOR development group within EA Los Angeles would rename itself Danger Close on the eve of the game's release. By situating the new MEDAL OF HONOR firmly within an ongoing war in Afghanistan with all of its attendant real world complexities and emotions, Danger Close (along with help from EA DICE) is certain to hit a raw nerve.

Already calls for the game's boycott are being heard on both sides of the Atlantic and the hammering that Atomic Games received for the unreleased SIX DAYS IN FALLUJAH is still fresh in memory. Certainly the industry will be watching to see what kind of reception MEDAL OF HONOR gets from the buying public. Will Danger Close reinvigorate the storied MEDAL OF HONOR franchise or burn it to the ground? Does reality have any place in the game industry?

Capy Games

:: Capy Games, formerly Capybara, fought its way up from the trenches of mobile game development, much as 5th Cell did, and has now positioned itself as the darling of the Toronto game development scene. Even as the company has continued to gain critical acclaim through releases like CRITTER CRUNCH and MIGHT AND MAGIC: CLASH OF HEROES, Capy has continued to push in artsy/indie directions. The company has taken an interesting tactic—release a new title or concept in a small package, iPhone and DS in the case of the two aforementioned games, then iterating on them for the HD space with digital download ports on the major HD consoles. Meanwhile the company cultivates its next off-the-wall project in collaboration with pixel artist Craig Adams, aka Superbrothers, called the SWORD AND SWORCERY EP.

Under the creative direction of Kris Piotrowski and the business savvy of Nathan Vella, the studio has created an interesting model of creativity and sustainability, allowing Capy to evolve in an organic way that larger studios would either scoff at, or severely envy.

Microsoft - Windows Phone 7

:: Windows Phone 7 devices will soon be shipping, and with them comes a new layer of Xbox Live. While you won't have to use Xbox Live on the phone, if you do, you'll have access to a cross-platform gamerscore, leaderboards, and friends list. XBLA ports abound, but iPhone and WiiWare conversions, among other original games, will also be featured.

Turn-based multiplayer and existing account tie-ins are the main draws aside from the suite of games, and development via XNA Game Studio means that bringing games to the platform won't be overly complex. As Microsoft's first real bid for the handheld gaming space, taking on not only the iPhone and Android but also the DS and PSP, this is a venture worth keeping an eye on.

CCP Games

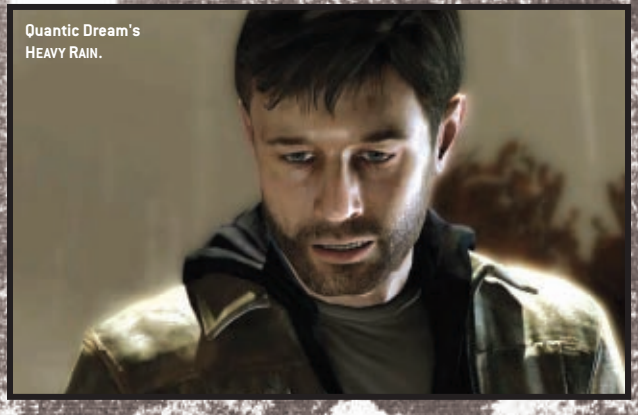
:: EVE ONLINE has been an astonishingly successful game for CCP but looking at it from the outside you might wonder why. Described as having a vertical learning curve, the game is cold, hard, and uncompromisingly committed to its own insular aesthetics. EVE also follows a subscription model at a time in which most of the MMO business seems to be rushing headlong into Free-To-Play (and in that rush lies the unspoken acknowledgement that players are not willing to pay a premium subscription price for many of these games). But more than 300,000 EVE players are more than happy to pony up $14.95 per month for the privilege of having a prized starship ripped out from under them by the GoonSwarm. Nothing worthwhile is easy and it is this harsh game environment that makes EVE so appealing to its players.

However, with the in-progress MMOFPS DUST 514, CCP is making a play for the console space by creating a game that caters to an action-oriented audience but contains hooks into the deep EVE ONLINE experience. It is an interesting design challenge and an ambitious technical achievement that could bring CCP's brand of hard-edged sci-fi to an even wider audience.

CCP Games' EVE Online.

Capy Games' Might and Magic: Clash of Heroes.

Danger Close Games' Medal of Honor.



Quantic Dream's Heavy Rain.

Nintendo - 3DS

:: 3D without glasses has long been a goal for entertainment media. Though the concept has been around for some time, the screens and technology required to make it happen were only recently realized. Nintendo's 3DS aims to tackle 3D in the relatively lo-fi handheld arena, allowing 3D gaming and movies in one device, without the need for glasses. The move is bold and expensive, but potentially game changing, both literally and figuratively.

Nintendo continues to push the envelope on the hardware side, creating interesting software to support it. This console, for the first time in a while, seems enough of a "common sense" iteration that third parties won't be left in the dust.

Quantic Dream

:: For years now Quantic Dream's David Cage has been promising a video game that adults can identify with, that speaks to a grown up experience of the world. His earlier efforts Omikron and Indigo Prophecy fell somewhat short of that goal but arguably with Heavy Rain Cage delivered. Here was a game that had little to do with the concerns of thirteen-year-olds, it was single-player, and it had limited replay value. The result? Over 1 million copies of the game were sold worldwide, proof that mature content sells.

Cage has ruled out sequels so it will be interesting to see what comes next for Quantic Dream. The studio invested heavily in mocap technology during the creation of Heavy Rain and the ability to imbue its characters with subtle human performances was certainly a contributor to the game's success. Whatever subject Quantic Dream's next game tackles, we can expect the studio to continue exploring the creative edge of digital acting.

Unity Technologies

:: Although we have yet to see truly breakout titles built with the Unity engine, that doesn't mean that we won't be looking at some in the very near future. Independents are increasingly drawn to the engine thanks to its budget-friendly licensing structure (the standard Windows and Mac version is free to companies earning less than $100,000 a year) and its cross-platform deployment capability gives Unity a real edge. Add to that, iPhone, Wii, and soon to be released Android versions, and Unity seems to be covering mass-market gaming devices quite well.

This populist approach is a smart move for Unity Technologies as it brings high quality tools to the grassroots level where it can help drive real innovation. And when it is time for the hobbyist, student, and indie to go professional, Unity Technologies is ready with the Unity Pro license that adds advanced graphics capabilities to the engine.

Runic Games

:: The game industry should be watching and learning from Runic Games' highly rational approach to development. Staying small, working fast, building only what's needed, and keeping close to their strengths as designers, the team at Runic is laying the foundation for a long-term presence in game development. Now that Runic's Torchlight is a proven success the studio is working on a sequel and is planning to leverage the Torchlight world into a full-fledged MMO. It's an ambitious plan that is dependent on keeping momentum rolling quickly from one project to the next. A larger studio might be in danger of stumbling or losing focus with such a strategy but Runic is uniquely configured to see it through for the win.

Apple

:: Few devices have generated as much excitement among game developers as Apple's iPhone and iPad. Drawn by the promise of independence and a return to a garage-coding frontier, developers have created more than 250,000 apps in the two years since the release of the iPhone SDK. Of course, striking it rich on the iPhone has not been as easy as some would have hoped. Instead, the App Store's pricing structure has created a rush to the bottom with quality games forced to compete with .99-cent time wasters. Adding to

developer's troubles has been a restrictive SDK and a less than transparent approvals process.

Still, Apple's "walled garden" approach to the iPhone and iPad is a big factor in the devices' success with consumers and so far developers have been willing to give up some control for access to an audience that is estimated at over 11 million. Fortunately, recent changes at Apple have improved the situation for developers. The new iOS 4.1 update brings with it the Game Center App that enables network play and social gaming features for the devices. Even more promising is the company's decision to allow third-party tools and programming languages in the creation of apps. Apple is also trying to be more open with its content review guidelines for the App Store, a move that should take some of the mystery out of the app submission process.

ThatGameCompany

:: The recently named JOURNEY is ThatGameCompany's final title in its three-game deal with Sony, in which TGS makes downloadable games for Sony's PlayStation Network service. JOURNEY continues the company's commitment to investigating new emotional experiences in games, while also pushing the developers into a new arena—the online space.

ThatGameCompany built its reputation on creating new and different experiences—but how will these experiences be enforced, subverted, or altered in the online space? How will this small team tackle adult cooperative play in a relatively open-world setting? That's what makes TGS a company to watch in 2011.

Blitz Games Studios' 1UP program

:: Indie games are gaining cultural relevancy everyday and with that higher-profile comes increasingly lucrative commercial possibilities. Among the big publishers, Blitz Games Studios was quick to recognize the growing market for independent games. But rather than trying to co-opt the movement, the Blitz Games Studios' 1UP program appears to be looking for a way to coexist with indies in way that is mutually beneficial to both sides.

The publisher's a la carte approach allows independents to pick only the development and publishing services that they need, whether it is development assistance, QA, localization, distribution, or marketing. It's a unique approach that is respectful to the spirit of independent games while still giving access to the resources that only a big publisher can muster.

Pixologic

:: It's been said that we do not yet have the 3D equivalent to Photoshop. That may be the case but Pixologic's ZBrush seems to be coming pretty close. With its Pixol technology that adds depth information to pixels, ZBrush attempts to make sculpting 3D objects as intuitive as painting on a canvas. The artwork empowered by ZBrush is startling in its fine details, etched with the grit of life and this rich visual fidelity is what distinguishes inspired art direction in games over the merely functional.

With its GoZ feature, ZBrush sits well in art pipelines, enabling artists working in Maya, 3ds Max, Modo, or Cinema 4D (with additional implementations promised in the near future) to quickly export their models to ZBrush for detailing and then export back to their model tool with newly created texture, displacement, and normal maps automatically connected to the appropriate shading networks. It's an intuitive process that allows artist to stay in the flow without getting bogged down by technical concerns.

Pixologic is also making an effort to bring ZBrush to as wide a user base as possible by keeping the software's price within the realm of consumer pocketbooks. As more and more artists are turned on to ZBrush, both at the professional and amateur level, it has a good chance of becoming one of the essential tools in game development.

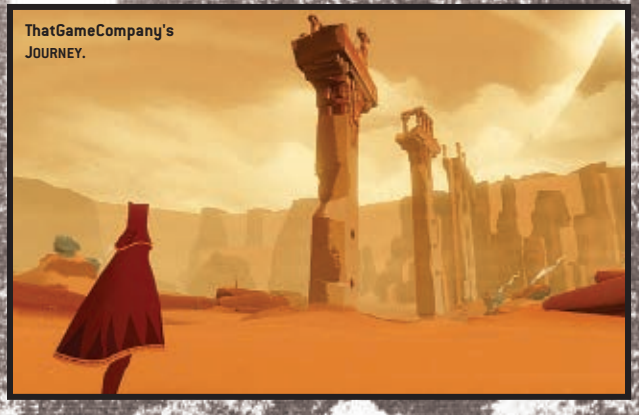
LucasArts

:: Here we have a company in constant flux. It seems as though with every new president comes a shift in internal studios and projects. The company was making a push back into the offline PC space, but then under new president Paul Meegan cut some of that staff in 2010. At the same time, LucasArts also hired former Ubisoft

Junction Point Studios' Disney Epic Mickey.

Arkane Studios' Arx Fatalis.

The Behemoth's Battleblock Theatre.



ThatGameCompany's Journey.

Montreal creative director Clint Hocking, known for his work on Far Cry 2 and Splinter Cell to work on an unannounced project. Likewise, the company has brought on Joe McDonagh, a senior BioShock designer from Irrational.

LucasArts is a venerable company with a number of high profile brands, and is clearly positioning itself to do something of note in the coming years. What that is, we'll have to wait and see—but with the kinds of hires the company is making, it will likely to be something very interesting.

GameStop

:: The game industry has a somewhat ambivalent relationship with GameStop. On one hand, the ubiquitous retailer is one of the primary outlets for new games and hardware. It also plays a secondary but still important role in promoting "gamer culture" to consumers. On the other hand, the company does a healthy business in used game sales for which the industry is denied any revenue. The issue has become contentious enough that publishers are beginning to employ strategies such as disabling online play in order to devalue their games on the used market.

GameStop is also facing increasing challenges from digital distribution as downloads make physical product superfluous. It's a transitional time for the company and it is easy to see how a Netflix-style disruption could leave brick-and-mortar game retail on the wrong side of history. Still, the current high cost of new games would seem to necessitate a packaged good in most consumers' minds. This can buy some time for GameStop in the short term but things change quickly on the technology front. As the game industry is pulled deeper into digital territory it is uncertain what a diminished GameStop might mean for game sales in the long run.

OnLive

:: OnLive launched this summer and reports suggest that the company's network streaming technology does in fact work as promised. In theory, the idea of jettisoning dedicated gaming hardware for something as simple as a fast broadband connection is pretty breathtaking in its implications. In practice however, the OnLive service still seems a bit too niche-y to change the world just yet. Computer hardware is still required (although fairly low-spec) to connect to OnLive, which unfortunately moves the game experience out of most living rooms. The service's pricing is also a work-in-progress with top-tier games selling for about what a copy would cost at retail. More interesting is OnLive's PlayPass system that is akin to renting, in which players can pay for multi-day access without having to buy a game in full.

OnLive is currently at work on their MicroConsole TV adapter that will allow players to connect to the service directly through their Ethernet router without the need for computer hardware. Along with this low-cost device is the distinct possibility that OnLive could partner with cable companies to build a game port directly into cable boxes (U.K. cable provider BT is already an investor in OnLive). This has the potential to be tremendously disruptive to the traditional console business and such a move would quickly take OnLive out of the niche and into the mainstream.

Google

:: Google's business has always been about connecting the dots. In the case of its Internet search engine, by connecting a billion dots of information into something coherent and useful. Over the past several years the company has broadened its interests into just about any conceivable venture that requires two connected computers. While some of its efforts can seem almost experimental (Orkut, Product Search, Picasa, among others), many of Google's products like Maps, YouTube, Docs, Blogger, and Chrome have become de facto standards. Now games are increasingly in the company's eyesight.

Google has recently been moving into the social games space with acquisitions of the development studios SocialDeck and Slide. It has invested heavily in the social giant Zynga and rumors of Google-created competitor to Facebook continue to float. Google's Android mobile OS is gaining mindshare, no doubt helped in this by an open framework that is in contrast to Apple's closed system. The company's Chrome web

browser will soon be host to the Chrome Web Store that will serve as a one-stop shopping center for Chrome-enabled apps including games. Google Checkout, the company's alternative to PayPal, will surely get a big boost in popularity once the Web Store comes online, giving independent developers an easy way to gather revenue from their work. The only mystery in connecting all these dots is the abrupt departure of Mark DeLoura, Google's game developer advocate, from the company after less than a year on job.

Junction Point Studios

:: Austin, Texas-based Junction Point has gone through some turmoil in recent years, with publisher deals rising and falling, and a surprise purchase of the company by Disney. What has remained firm though, has been the creative direction of Warren Spector, famed for his involvement in Looking Glass Studios and DEUS EX especially.

Now, Junction Point is looking to change the face of hardcore gaming on the Wii, while simultaneously reviving a long-standing icon of animation for a new generation. DISNEY EPIC MICKEY is that game, and the project is quite ambitious in scope, spanning decades of Mickey Mouse's "career" and legacy, while also allowing for creative and destructive gameplay solutions. The company is intrinsically tied to this title, making the eventual outcome all the more interesting to see.

Arkane Studios

:: Arkane Studios released its first title, ARX FATALIS in 2002 and over the years the game has slowly gained in critical appreciation, regarded by those who played it as a classic of dark fantasy. Since then, Arkane has worked on DARK MESSIAH OF MIGHT AND MAGIC and contributed to BIOSHOCK 2 but has not yet turned its attention to another wholly original creation on par with ARX FATALIS.

That may change now that the studio has joined ZeniMax Media. Standing next to industry giants like id Software and Bethesda Softworks is sure to inspire the studio and with the stability that ZeniMax offers, Arkane will have the resources to pursue ambitious new projects. Arkane also recently added DEUS EX lead designer Harvey Smith to its staff, a move that has players optimistic for a game with some of that old Ion Storm magic.

Indie Fund

:: The Indie Fund is an ambitious idea that if all goes according to plan could help launch a new generation of unique game design voices. An attempt at radically changing the relationship between publishing and development, the Indie Fund aims to finance game creation on a title-by-title basis, free from the pressure of milestones and long-term obligations.

The Indie Fund is also planning to make its funding agreements public, a practice that is unheard of in the current industry climate. That fact alone could signal an important shift in the game development balance that increasingly empowers creators. If it all seems a bit overly optimistic, it bodes well that the Indie Fund principles Jonathan Blow, Ron Carmel, Kyle Gabler, Aaron Isaksen, Kellee Santiago, Nathan Vella, and Matthew Wegner are themselves all individually successful game creators.

The Behemoth

:: How often does one see an indie company that can take as long as it likes to finish a project? The Behemoth's near-two-million-selling CASTLE CRASHERS has allowed the company to focus on iterating and evolving its next downloadable title, BATTLEBLOCK THEATRE, without worrying overly much about where its next meal will come from. In that time, the company has been supplementing its income with merchandise, but spending equally on tradeshow attendance and interfacing with fans.

To The Behemoth, good reactions from customers mean more than good press, so while you won't see BATTLEBLOCK THEATRE at E3, you're sure to catch it at consumer-facing events like Comic Con and the Penny Arcade Expo. The most curious thing is that the company has been showing the game in playable form at each event, showing fans the early rough spots all along the way. But has The Behemoth bet the farm on its new title? That's what makes indies so appealing—a blind dedication to the product.

top publishe

Video game publishing is a risky venture. Costs are high and the market is fickle, but a hit game can make up for a lot of mistakes. The most successful publishers, both creatively and financially, are the ones willing to take a smart chance. This is the spirit we look for in a company as *Game Developer* selects the top twenty publishers of the year, listed here alphabetically.

Activision Blizzard

:: World of Warcraft is still a massive moneymaker, not to mention the greatest argument for the continuation of the subscription model in online games. That alone would grant Activision Blizzard a place on this list—but when you add the success of Call of Duty: Modern Warfare 2, Guitar Hero, StarCraft II, and other high-profile titles, the publisher is certainly one of the most financially successful in the world.

Though the company has recently seen criticism for its dealings with its creative talent, it remains a powerhouse in both the offline and online game spaces. Whether it can innovate through inspiration from within rather than through acquisition, as it's done in the past, will determine the company's future success.

Atlus

:: Few companies have done more for the import game and JRPG space than Atlus. As the most prolific U.S. localizer of third-party Japanese game content, especially at the non-triple-a level, Atlus has been increasing the scale and scope of its output. The company was particularly lauded (and financially successful) for its 2009 release of From Software's Demon's Souls, which was published in Japan by Sony. This title, alongside the Japanese development team's Persona series, has cemented Atlus' position as a critical darling

Capcom

:: Capcom has been able to consistently deliver quality product for the Western market from its Japanese studios, while other Japanese companies have struggled with their initiatives. Capcom is also looking to rectify its missteps in Western-developed titles by partnering more carefully with specific studios under collaborative guidance such as the recent Blue Castle purchase.

The next few years will be very interesting for Capcom, which has been riding high off projects that began several years ago, stewarded by industry luminaries who have since left the company (Devil May Cry's Kamiya, Viewtiful Joe's Inaba). Capcom's future success rests on its ability to cultivate new talent.

Disney Interactive Studios

:: Disney has made a number of bids for the gaming space, but this has been its most concerted effort so far. Most notably, in buying Warren Spector's Junction Point Studios, the publisher has managed to get some gaming cache, while also pushing forward with its other notable studios and titles. The company also recently picked up Wideload, the studio of Halo cocreator Alex Seropian, in a bid to take the casual market—while also owning Playdom, one of the premier companies in the social games space. Disney is currently firing on all cylinders, and seems ready to take on all comers.

Electronic Arts

:: Electronic Arts has been working hard in the last few years to define itself as a company of innovation, shrugging off the stigma of a workmanlike license shop with which critics had branded it. Part of this conceptual change has come through its EA Partners initiative, which continues to bear fruit, even as the bread-and-butter sports sequels continue unabated.

Though the recent Brütal Legend was not a success, the move to pick it up was bold—and it's that boldness EA hopes to bring forward in its future partnerships, with companies like Grasshopper Manufacture and Epic. And through recent acquisitions of BioWare and Playfish, EA is making serious bids for both the hardcore and social game markets. Also of note is the company's initiative to encourage new game sales by including free, one-time-use downloadable content that customers buying a used copy would then have to pay for.

Konami

:: This is a company that's very much trying to turn over a new leaf. After many missteps in the Western market, Konami is starting to get itself together. The upcoming Spanish-developed Castlevania: Lords of Shadow looks promising, and the recent downloadable multiplayer Castlevania: Harmony of Despair has been very interesting from a critical perspective. Konami is trying to avoid just becoming a Metal Gear Solid house, and is branching out more intelligently than it has in the past. If its partnerships with developers in emerging markets succeed, as with Immersion Software and Slang's Lucha Libre AAA: Heroes Del Ring, Konami could be taking things in a whole new direction.

Microsoft

:: One of Microsoft's greatest triumphs this year has been the push to digital distribution. Multiple games have sold over a million units on the Xbox Live Arcade service, and Xbox Live Indie Games are picking up speed as well. The company's "Summer of Arcade" promotion has furthered the idea that high quality content can come to console via download.

Looking forward, the company's Kinect camera peripheral looks to change the face of motion games, by not including an actual controller. The proof will be in the pudding, but with all three big console manufacturers in the motion/gesture control business, that arena is going to look quite interesting in 2011.

Namco Bandai Games

:: Namco makes our list but only just—the company has struggled to find a real identity in the changing marketplace, relying on sequels to generate hits. But the company is taking a hard look at itself now, and seeing where it can find something new. Looking forward, new games in the Splatterhouse and Pac-Man series are a start, as is Ninja Theory's Enslaved: A Journey West. But in the last year the company has been relying heavily on licenses, to some decent success. How long this will remain viable will be critical for Namco's future, unless it takes a new direction.

Nexon

:: As the free-to-play market continues to grow, Nexon, one of the progenitors of that business model, is thriving. The company's product lineup is impressive, with Dungeon Fighter Online sporting nearly 200 million registered users worldwide as of April 2010. The company also pioneered the cash/point card model in which in-game money is sold via retail kiosks. Now that Nexon is pushing more aggressively into the U.S. market, the company's progress will be even more interesting to watch.

Nintendo

:: Whenever anyone says that the game industry in Japan is declining, one need only point at Nintendo to see that there's life in the ol' girl yet. Nintendo has consistently outsold nearly every company in terms of software, and certainly in terms of hardware, due to its different stance on game development, and "disruptive"

ideas about game hardware. As the company continues to roll out hits, like last year's New Super Mario Bros. Wii and the seemingly evergreen Pokemon series, it's no wonder Nintendo manages to stay on top. As it looks forward to the eventual launch of the 3DS, Nintendo is ready to make another round of big waves in the publishing industry, and potentially revamp its digital initiative, which so far has been its greatest failing.

Sega

:: While the company has certainly been fluctuating in the quality of its releases and has struggled to find a proper venue for its erstwhile mascot Sonic the Hedgehog, there have remained traces of the Sega of old amid the chaos. Notably, the company's partnership with Platinum Games continues to bear fruit, as Bayonetta was a critical darling, and the upcoming Vanquish looks to be an interesting new take on the third person shooter genre. If Sega can continue to build these kinds of relationships, we may have more opportunity to speak positively of the company in the near future.

Sony

:: Sony had a good year in 2009, on the back of several high-profile releases, including Infamous, Killzone 2, and Uncharted 2. Looking forward, the company is moving into the motion control space with its Move peripheral, which combines with its existing PlayStation Eye camera to form what the company claims will be the most precise gesture control on the market.

On the software side, while there are a number of games for PlayStation Move planned, The Last Guardian looks much more promising, and the company's PlayStation Network content continues to increase in quality.

Square Enix

:: With a new console generation, there must be a new Final Fantasy—Square Enix's Final Fantasy XIII was critically divisive, but generally a hit among fans, selling nearly 6 million copies worldwide. The company has continued to acquire new subsidiaries, such as Taito and Eidos, absorbing them or displaying them as it sees fit, and through this has grown into a behemoth of a development house. As the company makes a greater western bid, with titles like Front Mission Evolved and Eidos' Tomb Raider series, Square Enix is not sitting still when it comes to the expansion of the game industry into the Americas and Europe.

Take Two

:: Though investors continue to try to peg Take Two as a one-trick pony for its Grand Theft Auto series, Take Two has had an excellent year due to the release of Red Dead Redemption, which has taken the world by storm, both critically and financially. What those analysts forget is that the company also owns the BioShock and Civilization franchises, both very important to the gaming community, and good sellers in their own right. Another under-valued aspect of the publisher is its willingness to continue finding the right venue for a product. Grand Theft Auto: Chinatown Wars under performed on the DS, but then was ported to the PSP—and then again to iOS, and later given an HD remix for the iPad. The company knew it had a good game, and kept poking it until it found the right home, and is now one of the better selling games on Apple's iTunes service.

THQ

:: Though the company has been a bit down on its luck recently, THQ has continued to hold the flag for PC gaming, which is certainly admirable. With strong showings from the PC versions of Metro 2033 and Red Faction Guerilla, THQ is showing no reluctance to publish in the non-MMO PC game space, which many publishers shy away from. Now that the company's cash cow, the Pixar license, has gone away, THQ is trying to focus more on original IP. Though early steps have been rocky, and the company is still learning how to manage sequels, the more THQ tries to push in new directions the better.

Ubisoft

:: There has been speculation as to how long Ubisoft can continue privileging creative innovation over sales in the AAA space, but as long as it can keep going, critics and fans will keep appreciating it. With genre-defining titles like Assassin's Creed 2 and Splinter Cell: Conviction released in the last year, Ubisoft is clearly doing its best to put art before all else. Now that the company has announced the ambitious From Dust by Eric Chahi, and collaborative tools for game creation from Michel Ancel, it's clear that this is a road down which Ubisoft wants to continue. As long as it can continue to stay profitable, be it through Canadian tax breaks, or multi-million-selling games like Assassin's Creed, we don't see why anyone should question it.

Valve Corporation

:: Valve has been a friend to indies and big game companies alike with its digital download Steam service, which has helped companies to circumvent piracy, and get their games out to customers as PC retail shelf space dwindles. Now, Valve has also reversed its position of avoiding the PlayStation 3, and is bringing Portal 2 to the console, with some vague promise of Steam integration.

Valve brought Steam to the Mac OS this year, and with that should come Mac versions of its back catalog. If digital distribution of full, AAA titles is to become the norm for the average game player, Valve is laying the groundwork to quickly become the default service.

Warner Bros. Interactive Entertainment

:: Through a series of key acquisitions, investments, and the building of new studios, Warner Bros. has suddenly positioned itself as a publishing powerhouse. 2009's Batman: Arkham Asylum, as well as the company's publishing relationship with the innovative 5th Cell (Scribblenauts), have rocketed the company to the forefront of critical acclaim. With companies like Monolith and TT Games in its stable and a wealth of intellectual properties from which to draw, Warner Bros. seems a sure bet for future excellence—so long as the company can maintain the creative integrity of its developers.

ZeniMax Media

:: ZeniMax Media has been blazing trails in the open world arena, with games like Fallout 3 which has been continually updated with new content, The Elder Scrolls IV: Oblivion, and a host of other titles. Now that the company has purchased id Software and Arkane Studios, it stands ready to dominate the arena of the "thinking man's FPS." The motto of this company seems to be "go big or go home" (with some notable exceptions), and as long as that continues to work, more power to them.

Zynga

:: As the 800 pound gorilla in the social games space, Zynga has a lot going on. There's a lot of innovation, a lot of accusations, and a lot of acquisition going on within the company, as it alternately thrives and is criticized by having far and away the largest media profile of any social games outfit. Zynga has proved it could move beyond FarmVille, as it continues experimenting with what works in the space, and blazing trails for others to follow (while also refining the existing ideas of others). Zynga is certainly one of the biggest companies to watch in the space, with its 1,000 employees and scads of venture capital.

UNREAL TECHNOLOGY NEWS

BY Mark Rein
Epic Games, Inc.

UNREAL ENGINE 3 COMES TO MOBILE

This month I thought I'd venture away from the usual format of talking about some cool things our licensees are doing. Instead, I'm going to talk about how UE3 is now the most amazing mobile game engine on the planet and how it is already changing the face of mobile games forever.

On September 1, 2010, we appeared onstage at the Apple Special Event to demonstrate Project Sword, our first Unreal Engine 3 game for iOS devices, and announce to the world that we are making UE3 available to iOS developers. If you did not see the event then I urge you to search YouTube for "Apple Special Event Project Sword."

That day, we released Epic Citadel, a free download on the iTunes App Store for recent iOS devices. Epic Citadel lets you explore an environment from Project Sword but more importantly provides a tiny glimpse into the exciting future of triple-A mobile games.

It shows off a stunning parade of visual effects that you likely have not seen before in a mobile environment, including: bump offset mapping, normal mapping, texture blending with painted weight maps, global illumination and dynamic specular lighting with texture masks.

In its first 10 days, Epic Citadel was downloaded by more than 1 million users. Here's a sampling of what the media had to say about what they saw:

I certainly never thought I'd see graphics like that on a mobile game.

Epic Games opened plenty of eyes with its beautiful-looking swords-and-castle-exploring game demo.

It's so exciting, I can't describe it. My iPhone 3GS is suddenly a handheld Xbox 360.

Download Epic Citadel right this very second from the App Store. Genuinely speechless... well, apart from all the swearing.

If you thought that games on the iPhone and iPod touch had to be silly-looking glorified minigames, Epic Games' new Project Sword may blow your mind.

Seriously! I have a strange feeling everything's just changed.

I think the last two quotes illustrate something we at Epic have understood for a while now - that mobile gaming is quickly changing. Speaking about Apple TV at the event, Steve Jobs said, "the HD revolution is over, it happened, HD won. Everybody wants HD." I think this sentiment will apply to mobile gaming as well. That doesn't mean 2D games are going to cease to exist but, as more UE3-based mobile games appear, 3D games will need to deliver higher levels of graphical fidelity to remain competitive.

It is clear that until people put their hands on an app like this they had no idea how powerful iOS devices are or how captivating a 3D experience they can deliver, and people want to have more experiences like this.

We're ready to help developers give consumers these new experiences. If you want to be ready please contact us about licensing Unreal Engine 3. BTW, it also works on PC and console.

...THIS INCLUDES UDK

There are now more than 350,000 unique installations of the Unreal Development Kit and we're excited to announce that UDK will also support iOS devices in the near future. For more on this feel free to follow me, @MarkRein, on Twitter.

Canadian-born Mark Rein is vice president and co-founder of Epic Games based in Cary, North Carolina.

Epic's Unreal Engine 3 has won Game Developer magazine's Best Engine Front Line Award four times along with entry into the Hall of Fame. UE3 has won three consecutive Develop Industry Excellence Awards.

Epic is the creator of the mega-hit "Unreal" series of games and the blockbuster "Gears of War" franchise. Follow @MarkRein on Twitter.

UPCOMING EPIC ATTENDED EVENTS

GDC Online
Austin, TX
October 6-8, 2010

Montreal International Game Summit
Montreal, Canada
November 8-9, 2010

IGDA Leadership Forum
San Francisco, CA
November 4-5, 2010

Game Connection
Lyon, France
November 16-18, 2010

Please email: mrein@epicgames.com for appointments.

WWW.EPICGAMES.COM

17 BETTER BREAKING GLASS THROUGH SHADERS

JT HOOKER

MOST GAMES SET IN REALISTIC ENVIRONMENTS WILL NEED TO HAVE SOME SORT OF INTERACTION WITH THE SHATTERING OF GLASS. THE SIMPLISTIC APPROACHES OF THE PAST ARE NO LONGER RELEVANT IN THE CURRENT GENERATION, AS PLAYERS EXPECT MORE REALISTIC DESTRUCTION OF OBJECTS OF ALL TYPES. WHEN IT COMES TO SHATTERING GLASS, EXPECTATIONS ARE EVEN HIGHER, AS THIS IS SOMETHING THE PLAYER IS MUCH MORE LIKELY TO HAVE ACTUALLY SEEN HAPPEN IN REAL LIFE. RED FACTION ARMAGEDDON TAKES A NEW APPROACH TO REALISTIC-LOOKING SHATTERED GLASS, ITERATING ON OUR PAST DESTRUCTION METHODOLOGY FROM RED FACTION GUERRILLA.

RED FACTION GUERRILLA'S APPROACH

» Our Geo-Mod 2.0 engine, which we used in RED FACTION GUERRILLA, was able to reproduce the destruction of concrete, metal, wood, and composite materials gloriously. But when it came to putting glass into our buildings, it was too heavy-handed. As debris breaks away from a building in the Geo-Mod engine, many things are simulated. The effect on the structural integrity of the building is calculated and stress is applied. The debris is able to damage enemies, the player, or even smash through other walls of the building.

Glass windows are generally not load-bearing. The shattered glass pieces that fly from them when they break are also not likely to cause major structural damage. A more traditional system was needed, but it still needed to fit into the highly destructible Martian world we had created.

We implemented a technique for splitting the panes of glass into triangles, radially. The center of the effect was the point where the shatter was triggered. The pieces that flew away from the impact point would either be triangular or quadrilateral,

SHATTERED

FIGURE 1 The new glass shattering system in RED FACTION ARMAGEDDON.

FIGURE 2 **Breaking glass in RED FACTION GUERRILLA consisted of dynamically created triangles (on the left) with particle effects layered on top (middle and right).**

where a couple triangles would stick together. These triangles were render effects only and did not need to have physical collision or do damage.

IMPROVEMENTS FOR RED FACTION ARMAGEDDON

>> During pre-production on RED FACTION ARMAGEDDON, shattering glass was one of the areas identified as needing improvement. The system used in GUERRILLA was on par with other games, but we wanted something that would stand out as much as the rest of the destruction system. We started by doing research into film. We found that most action movies with large amounts of shattering glass, such as *The Matrix* and *Face/Off*, make use of glass that appears to be tempered. This gives a more chaotic and appealing look as the glass explodes into thousands of shards.

Another appealing effect of tempered glass is that many of the shards initially stick together in large clumps. Those chunks of glass break apart and fall away, and then usually break into tiny pieces after a secondary impact with the ground or other surfaces. Therefore there is no need to track glass pieces lying on the ground since they will shatter to dust.

We knew we wanted to duplicate the look of tempered glass, but we also knew that creating enough triangles to represent thousands of shards wasn't going to be possible. The rest of the destruction system uses enough of the processing power of the consoles that we didn't want to spare much for the glass system. The obvious alternative was to somehow get that jagged look entirely via textures.

The final solution was to use a single tile-able texture to define the jagged edges on any set of triangles. With all the triangles using the same UVs and lined up next to each other, combined with a cracked tempered glass diffuse texture, the window appears to splinter into thousands of pieces with large and small ragged chunks falling away. With a particle effect of glass dust layered on top and another particle effect when those shards collide with the world, it looks just like in the movies. Figure 1 (left) shows the results in-game. Compare this to Figure 2 (above), which shows an example of shattering glass in RED FACTION GUERRILLA.

IMPLEMENTATION

>> The question then became, "How do you create a texture that could make any arbitrary set of triangles appear to have jagged edges?" The answer is that the texture itself encodes the jagged shapes per pixel. To do this, we need a way of specifying, per pixel, what jagged shape the pixel belongs to. Using a separate tool described later, a texture is generated where the color value of each pixel specifies the relative location of the centroid of the jagged shape that pixel is within. We call this texture the "shatter map."

Figure 3 shows an example of the shatter map used in RED FACTION ARMAGEDDON. Here, for each pixel, the distance to the centroid is stored in the following way: the alpha channel is positive Y distance, red is negative Y distance, green is positive X distance, and blue is negative X distance. When sampled, this texture gives the shader vital information about the shapes we want along

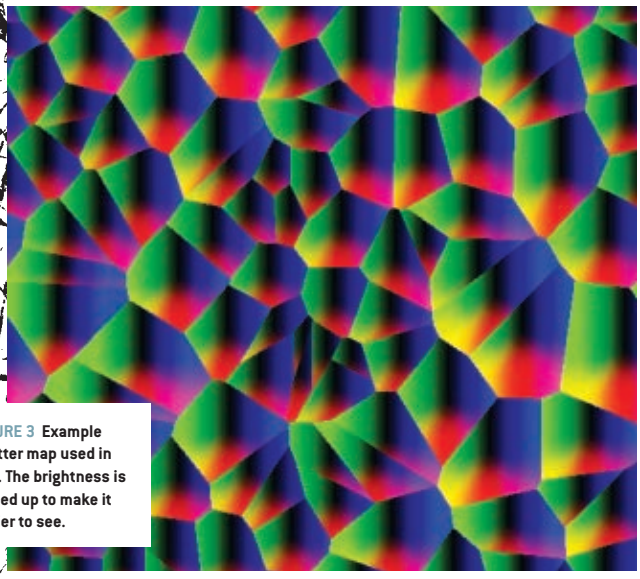


FIGURE 3 **Example shatter map used in RFA. The brightness is scaled up to make it easier to see.**

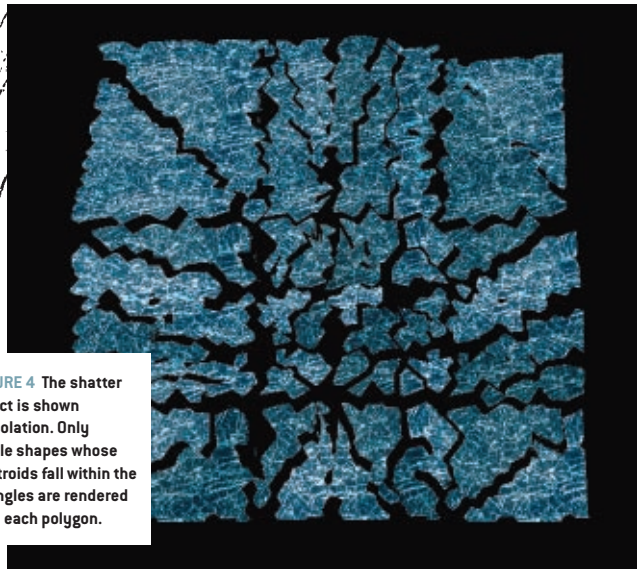


FIGURE 4 **The shatter effect is shown in isolation. Only whole shapes whose centroids fall within the triangles are rendered with each polygon.**

the edge of each triangle. Different sets of pixels point to different centroids, thus defining the jagged shapes.

The next problem is a common one. We plan to implement our effect in the pixel shader, comparing a texture against the current triangle. Traditionally, the pixel shader has no knowledge of the triangle it's rendering when called per pixel. All it has are values interpolated from three different executions of the vertex shader. The next step is to give the shader information about the triangles themselves.

We'll use the same set of triangles we would have used on RFG. We need to output some data from the vertex shader that the pixel shader can use to determine the triangle being drawn. For this we add all the 2D triangle edges to the vertex data. In our case we put triangle points 1 through 3 in texture coordinate channels 2 through 4. Each triangle point is stored as the vector from the current vertex to that point.

The vertex shader simply passes this data through from the vertex on to the pixel shader. Each time the pixel shader is executed, this data is interpolated between the three contributing vertices. Since the distance to each vertex changes linearly across the face of the triangle, the interpolated values are still a correct measurement. Now we always have accurate vectors to the triangle corners for each pixel.

Now the shader has per-pixel access to the relative position of a centroid and the relative positions of the three corners of the entire triangle. Using this, we can test to see if the centroid is within the triangle. If it's not, we can use HLSL's "clip" function to avoid rendering the pixel. This means any complete jagged shape whose centroid falls within the triangle is rendered while any outside are not. Figure 4 shows the result.

One catch to this is the original triangles don't encompass the jagged shapes; they merely define which ones to draw. So instead of using the points of the triangle as the vertices to render, we render a quad that's bumped out from the original triangle enough to contain the jagged shapes. The method of storing the distance from each of these vertices to the triangle points still works. Figure 5 shows wireframe for both the original triangle and the quad we're actually rendering.

Listing 1 shows the shader code used to achieve the effect in this example. The shatter portion is fairly simple and doesn't add much complexity to the original glass shader. The additional map sample is perhaps the most significant cost. When the effect is rendered, a diffuse texture that matches the shatter pattern is used to complete the look.

The 2D triangle points that were passed through the vertex shader from the texture coordinate data come in to the pixel shader combined with the UVs for the triangles. These are the inputs `uv_edge1` and `edge2_3`, with two elements assigned to each set of data.

When the shatter map is sampled to get the distances to the centroid, the data naturally comes in as color values between 0 and 1. It is necessary to convert these values to the same scale that the vertex data is on. It's not practical to use this as a percentage across the entire face of the pane of glass. If a value of 1 in the texture represented the entire distance across the pane, there would not be enough precision in an 8-bits per component texture to represent detailed shapes.

We multiply the shatter map sample by `SHATTER_CONVERT_CONSTANT` in the shader to convert it to the right range. For simplicity's sake, the units I use in the texture are a direct count of pixels to reach the centroid. If the centroid were five pixels to the right, I would store a 5 in the green channel. The shader hardware divides this by 255 to renormalize it to a value between 0 and 1. Therefore we will need to convert it back to a count of pixels by multiplying by 255, and then convert it to game units by dividing by the number of pixels per game unit (often meters). This makes the shatter convert constant equal to 255/(pixels per game unit). The number of pixels per game unit is dependant on how large the pane of glass is and how many times the texture is tiled, so it's most convenient if the shatter constant is uploaded by the game.

The test to determine whether the centroid is inside the triangle is done by finding out which side of each edge the centroid is on. Given edges that are specified in a clockwise order, if the centroid is to the "right" of all three edges, it must be within the triangle. We can test this by getting the dot product of the vector from the leading point on an edge to the centroid with the vector that's perpendicular to the edge. The perpendiculars are built by hand, swapping the X and Y components and then negating X. If the result of the dot product is positive, the centroid is on the correct side of the triangle edge.

FIGURE 5 **A single quad is shown in red wireframe. The vertex texcoord data contains the points of the yellow triangle.**

It's important to note that some versions of the HLSL documentation define "clip" as the following: "Discards the current pixel if the specified value is less than zero." A more accurate definition is "Discards the current pixel if any component of the specified value is less than zero." Since clip tests all three components of a value, we can put the dot products for all three sides of the triangle into a single `float3` and only have to call clip once. This will clip the pixel if any of the dot products are negative. This allows us to conditionally render the pixel without any use of if statements.

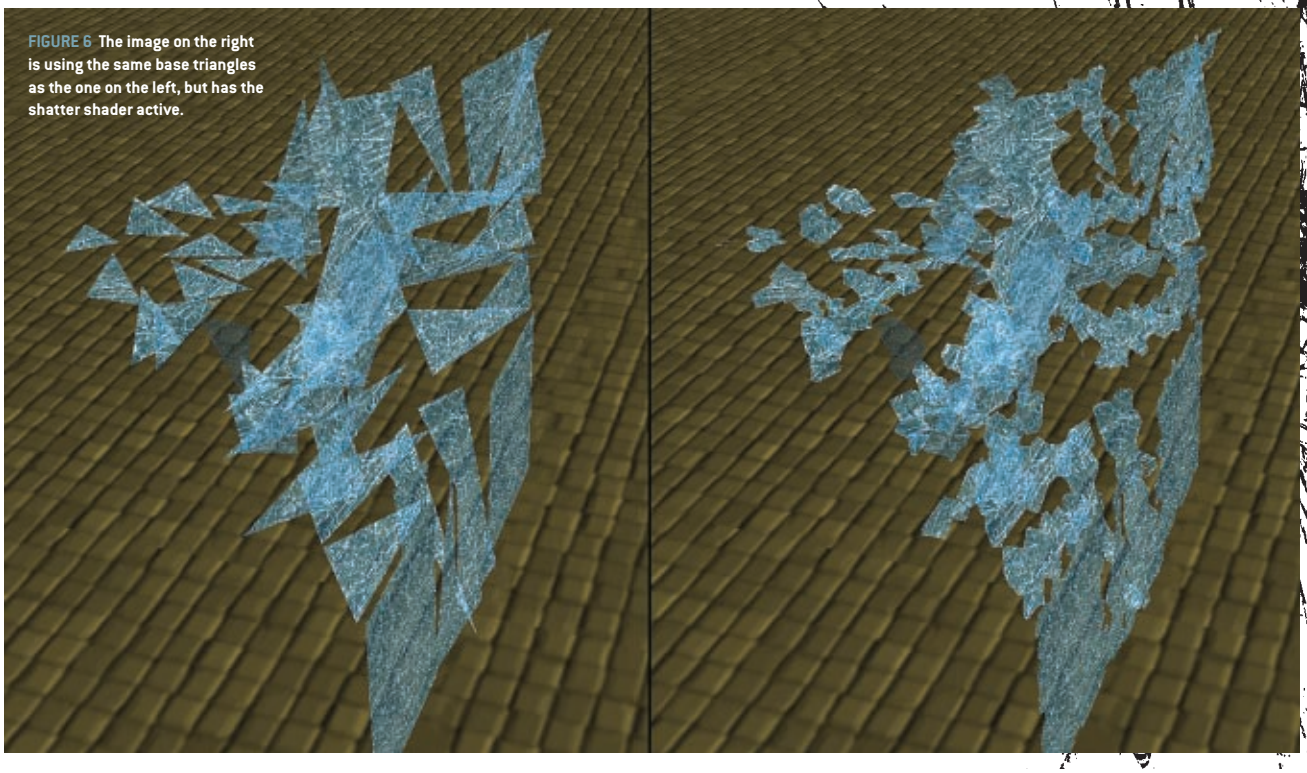


FIGURE 6 The image on the right is using the same base triangles as the one on the left, but has the shatter shader active.

BENEFITS

>> The primary benefit of this technique is the triangles that are used could be quite simple and the resulting appearance will still be passable. Figure 6 shows a very simple grid-based triangulation of broken glass. Without this effect, more triangle detail would be necessary. The implementation in the screenshot only uses 50 double-sided quads.

Another important benefit is reduced code complexity. A simpler triangulation method for the glass pieces can save implementation time as well as memory, and potentially performance, due to fewer vertices. The only additional code necessary in-game is the code that adds the triangle points to the quad vertex data. Add to that only a few lines in the shader and the developer overhead is minimal.

This approach also has a great deal of flexibility. Because the broken edges are controlled by a single planar-mapped, tiled texture, any set of shapes could go into that texture to control the appearance of the effect without any code changes. For the broken glass shown in these screenshots, a randomly generated polygon pattern is used. But you could also use this for a map that contains puzzle pieces, bricks, splintering shapes like wood, or anything else that is desired.

OTHER CONCERNS

>> The first issue to keep in mind is that the quads that are actually rendered need to be wide enough to contain the shapes that might hang out of the triangles. That means the specific size of the quads is affected by the data in the shatter map texture. In a system where artists will be creating the texture and deciding on the UV tiling, a good compromise has to be reached for the maximum size of the shapes in the shatter map. Also, for shattering glass, the quads should not be bumped out past the dimensions of the original pane of glass.

Another important thing to consider is that bilinear filtering should be disabled on the shatter map when setting up the glass shards to render. Point sampling should be used instead. This is because with filtering enabled, any samples that happen to fall between texels on either side of a shatter shape boundary will return incorrect values. They would interpolate between the two shapes and return some small value for the distances to the centroid which would create tiny spiderweb-looking lines that appear in the area of the quad where the rest of the shapes have been clipped.

Mip-mapping should be disabled for a similar reason. The blending of per-texel data that occurs when generating the mips would be completely incorrect. At a distance, the effect would completely break down. Also, any texture compression likely shouldn't be used since most compression methods will slightly change the color values stored and distort the shatter shapes. The lack of mips helps offset the additional size of the uncompressed texture. Using filtering, mips, and compression on the diffuse texture or any specular, reflection, or normal map textures is still acceptable.

Unfortunately, another side-effect falls out of using point-sampling on the shatter map. Each texel in the shatter map stores the distance from itself to the centroid, but the sample will not lie exactly on the center of the texel. As a result, there are slight inaccuracies between the samples. This only matters if the centroid of a shape happens to be almost exactly on the edge of one of the triangles. For some samples, that shape will appear to be outside the

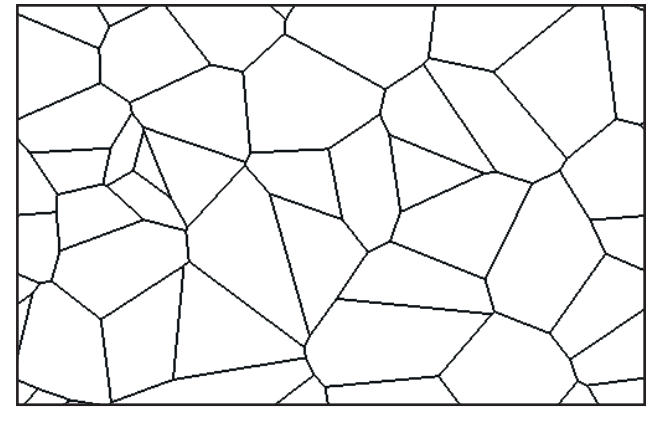


FIGURE 7 An example template image output by the Voronoi pattern generator is shown.

triangle while others will show it inside. This results in a flickering artifact that looks something like Z-fighting. It is fairly rare, though, and only takes up a small amount of screen space. The effect is usually moving fast enough that it's not noticeable at all.

The final thing to keep in mind with this approach is that there is a certain amount of additional shader overhead. Most of the code in the listing is the general shatter code that would have to be added on top of whatever glass shader the game is already using. In RED FACTION ARMAGEDDON, our common glass shader already samples a diffuse map, a dust map, a reflection map, and a normal map. We add to that the shatter map sample and the additional shatter calculations to create our shatter shader.

Because the technique renders whole quads that cover much more screen space than the original triangles, overdraw can be an issue. Combined with the additional shader expense, it's important not to layer this effect too deep or allow it to stay on the screen too long. In RED FACTION, the glass shards go flying and disappear on impact with the ground or walls, meaning the effect is only visible for a few seconds.

We also limit the number of panes of glass that will play the effect and the number of shards that can be created in total. So when an entire multi-story building is collapsing, or a truck is smashing through a small town, only the most prominent windows will play the effect. This doesn't hurt the visuals much, since most of the windows either aren't visible or will be obscured by other destruction effects.

LISTING 1

```
float4 shatterPS(
    float3 diffuse   : COLOR0,
    float4 uv_edge1  : TEXCOORD0,
    float4 edge2_3   : TEXCOORD1) : COLOR
{

    // Get the relative points on the triangle.
    float2 pt1 = uv_edge1.zw;
    float2 pt2 = edge2_3.xy;
    float2 pt3 = edge2_3.zw;

    // Sample the shatter map and calculate the centroid offset.
    float4 shard_sample = tex2D(ShatterSampler, uv_edge1.xy);
    // We add the values of the components and convert it into
    // the right range.
    float2 centroid = float2(shard_sample.g - shard_sample.b,
        shard_sample.a - shard_sample.r)
        * SHATTER_CONVERT_CONSTANT;

    // Make sure that the centroid is inside the triangle.
    // First we generate perpendiculars for each side of the triangle.
    float2 test_one = float2(pt1.y - pt2.y, pt2.x - pt1.x);
    float2 test_two = float2(pt2.y - pt3.y, pt3.x - pt2.x);
    float2 test_three = float2(pt3.y - pt1.y, pt1.x - pt3.x);
    // We dot the perpendiculars from each corner with the vector
    // from that corner to the centroid. If any of these dot products
    // are less than one, the centroid is outside of the triangle.
    float3 sides;
    sides.x = dot(centroid - pt1, test_one);
    sides.y = dot(centroid - pt2, test_two);
    sides.z = dot(centroid - pt3, test_three);

    // Clip this pixel if the center point is past any of the
    // triangle sides.
    clip(sides);

    // Return the diffuse texture times the lighting.
    return tex2D(Sampler, uv_edge1.xy) * float4(diffuse, 1.0);
}
```

USE IN RED FACTION ARMAGEDDON

» To enable our artists to use this effect in RED FACTION ARMAGEDDON, I created a simple stand-alone tool for creating the shatter map easily. The basic function of the tool is to generate a random shatter map based on a Voronoi diagram. A Voronoi diagram is a collection of shapes generated based on a set of points. Each shape is the area that is closer to a given point than every other point. The texture tool generates the Voronoi shapes by starting with a random number of points in the texture. For each pixel, it then determines which of the points are closest. Any two neighboring pixels that are closer to different points define the edge between the shapes.

When the border of a shape is discovered, black pixels are written to one of the output textures. This texture will be the template that artists can use to paint a usable diffuse map. Figure 7 shows the template texture that was utilized to create the diffuse texture used in-game. As long as the distance from each point is calculated as if the texture were tiled or wrapped around, then the output textures will tile perfectly.

RESOURCES

Information on Voronoi Diagrams:
http://en.wikipedia.org/wiki/Voronoi

As the tool loops through the pixels, it keeps track of the 2D bounding boxes of each shape. Once these are all known, the shatter map can be written out. For each pixel in the shatter map output, the corresponding Voronoi shape is found, and the distance to the center of its bounding box determines what colors to put in the shatter map.

The tool also supports a second, artist-driven usage. Any image can be loaded for processing. Distinct shapes are detected by difference in color between pixels. A second pass removes thin border pixels and assigns them to the shapes they border. Again, bounding boxes are tracked, and the shatter map is written out the same way. This allows an artist to paint or otherwise generate any tiling set of shapes and create a shatter map for them.

In ARMAGEDDON, the shatter effect is used in addition to RED FACTION GUERRILLA's glass fragmenting code. The combination of this shader effect and the radially breaking triangles from the original system makes for a very appealing look. As the pieces break away from the impact point, a fraction of a second delay is added to their movement to give the impression of a shockwave. We also added simple collision to the shards so they will break into dust on impact with the ground. The dust was accomplished with a particle effect.

Because the forces on these pieces are directly calculated from the destruction data in the Geo Mod engine, it looks just as realistic whether a sledgehammer is shattering the window or the entire building is splitting down the middle!

The author would like to thank Andy Cunningham, who wrote the original shatter system for RED FACTION GUERRILLA and Mike Flavin, who suggested improvements to this shatter shader.

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postmortem

FINAL FANTASY XIII

sw XI

The FINAL FANTASY series is not only one of Square Enix's flagship titles, but also a brand that represents the JRPG genre as a whole. As such, the FINAL FANTASY XIII team was tasked internally with a mission to sell over five million copies worldwide. FINAL FANTASY VII (PlayStation) and FINAL FANTASY X (PlayStation 2) were released in step with console generation shifts. Both titles are recognized for setting new standards, not only in the JRPG genre, but also in terms of graphics, gameplay, and storytelling. With these expectations already in place, the objective in developing FINAL FANTASY XIII, the first entry for the series on the PlayStation 3, was to create something that would have a similar impact both in terms of gameplay and craftsmanship.

FINAL FANTASY XIII

The project goal was to create a game with the expected impact of a numbered FINAL FANTASY title. This was quite an abstract concept, to say the least. Trying to realize such a goal, open to so many different interpretations, was something that the team would struggle with throughout the course of development.

With the advent of the PS3, and recognizing the pillars of what makes a FINAL FANTASY game, we knew we had to shift our development off of the PS2. Around that time, the notion that game engines should be created in-house for the new generation of consoles was also gaining momentum. While it would take a great deal of time initially, our idea was that a custom engine would increase productivity in the long run. The platform change required a major overhaul of our existing development practices. However, the direction of the game and its scenario did not stray too far from what was originally envisioned for the PS2. And the development strategy was simply an extension of our traditional practices, in which team members with specific skill sets, such as character modelers or background artists, would focus solely on the areas of their expertise.

We faced many challenges in the earlier half of development, but there was a definite turning point when the situation began to improve. It seems standard to start a postmortem with the things that went right. However, in this postmortem, we'll be taking a look at the project in the chronological order of events, which necessitates starting with what went wrong.

WHAT WENT WRONG

1) LACK OF A SHARED VISION. FINAL FANTASY XIII was first introduced through a concept trailer shown alongside the announcement of the FABULA NOVA CRYSTALLIS project at E3 2006 (FABULA NOVA CRYSTALLIS represents a suite of games and other entertainment media related to FINAL FANTASY XIII). The trailer was merely a visual concept, and we had not yet created anything playable at that point.

I felt that this trailer set the bar for the quality we were aiming to achieve, in terms of battle speed and cutscene imagery, and believed that this sentiment was shared by the rest of the team. However, it became clear that, at the time, there were actually very few members who saw the trailer as a representation of what we wanted to achieve with FINAL FANTASY XIII. This lack of a shared vision became the root of many conflicts that arose later in development.

2) THE UNIVERSAL ENGINE AND NARROWING DOWN THE SPECS. Another issue was the universal engine. Because we were so focused on creating an engine for next-gen hardware that could be utilized across all platforms, we made the mistake of trying to accommodate every single project that was in progress at the time. In hindsight, it should have been obvious that it would be impossible to fully satisfy all of these needs. As a result, we spent a

GAME DATA

PUBLISHER
Square Enix

DEVELOPER
Square Enix Product Development Division 1

RELEASE DATES
Japan: December 17th, 2009
North America, Europe, and Australia: March 9th, 2010

PLATFORM
PlayStation 3, Xbox 360

considerable amount of time prioritizing all the different requests and ended up not being able to determine the final spec requirements. This created a standstill between the engine and game development teams, because if the engine's specs couldn't be finalized, neither could the game's. As the debates continued without resolution, the timetable was also affected.

3) GETTING STARTED ANYWAY. As all of this was going on, the staff involved directly with the actual data construction had no choice but to start working before the specs were finalized. Their main concern was that they would not be able to keep up with the schedule if they continued to wait for final decisions. After calculating the estimated total data volume from the unpolished script and key learnings from past projects, the team felt a steady increase in staff was necessary. With the expansion of the team, lines of communication became muddled, and even after the specs were finalized, we had to backtrack. In some cases, the data created could not even be used. Not only was this a waste of time, it also decreased the team's motivation.

4) THE LIMITS OF THE TRADITIONAL TEAM STRUCTURE. As the project's scope increased, the traditional development style of dividing the team into specified roles, such as character modelers or texture artists, started to present issues as well. This problem of over-specialization presented itself in each discipline. The biggest problem was that the project became bloated with the increase in staff within each department. And because roles were so specific, the communication flow became faulty and information was not being shared properly. One specific example was that updates or confirmations regarding specs would not get through to every team member, and at times, the staff would continue to create data without knowing the most up-to-date status.

Departments that communicated very closely would actively share information, so there were no problems there, but these cases were based strictly on individual communication skills. For example, when we looked collectively at our in-game locations, which are basically what each level of the game could be broken down into, there were instances where what the artist and game designer had initially agreed upon would somehow shift due to the effects of another section's progress; and it was apparent that information was not being transferred properly.

In the past, we had always created graphical assets that were presentable from all angles, so that they could be adapted for any situation. During development, there was an unspoken rule to craft everything in full detail. However, in transitioning to modern consoles, the limit for detail became too bottomless, infinitely increasing the workload to create each asset. As a result, some team members would exhaust their energy by crafting a fully detailed asset that would only appear for a split second in the actual game.

5) INTERNATIONAL PLAYER TESTS THAT CAME TOO LATE. Even before the current generation of consoles was introduced, it was obvious that the game market in the West was gaining momentum, and we couldn't ignore it. The sentiment that stood out the most to us at the time was the increasingly harsh criticism towards JRPGs. Linearity and command-based battles were two of the features being perceived negatively. This was something that the team was very conscious about, and there were concerns about whether JRPGs would still be accepted in the West. Because FINAL FANTASY XIII's mission was to succeed worldwide, we could not ignore this issue, as we felt it could deeply affect the future of the franchise.

Around the same time, we were experimenting with Western development methods, and there were talks within the team of global focus groups, which we had rarely conducted with previous projects. At the same time, Square Enix set up international focus groups for certain titles, including FINAL FANTASY XIII. Unfortunately, we were already quite far along in development, and knew it would be too late to implement most of the feedback from the player test

sessions. Even so, we still signed up for the opportunity, as this would be our only chance before the game's release to see how Western players would respond to all that we had been working on.

There were some minor hiccups, as we did not have much time to prepare for the focus group sessions, but we were able to successfully conduct player tests and interviews globally. Even though it was too late to apply the majority of the feedback, most team members felt the tests were worthwhile, as it gave them insight into what players wanted globally. With the changes that were being considered, because of the lack of a clear communication line, the development team was not receiving clear instructions. This resulted in conflicts within the team on whether it was worth forcing certain changes into an already tight schedule.

WHAT WENT RIGHT

Because of this combination of a lack of a shared vision, heavy reliance on the development tool and the traditional team structure, the project went through some rough times. However, we were able to resolve our issues and ultimately push the project forward through the following methods.

1) REALIZING A SHARED VISION THROUGH THE DEMO. Even at a late stage of development, we did not agree on key elements of the game, which stemmed from the lack of a cohesive vision, the lack of finalized specs, and the remaining problems with communication between departments.

What enabled us to conquer this line of seemingly endless conflicts was the development process for the FINAL FANTASY XIII demo, which was included in the Japan-only Blu-ray version of the animated film *Final Fantasy VII: Advent Children Complete*. The demo was not in our original plan, so we had to make adjustments to the overall schedule to accommodate it. Whatever effects creating the demo had on the schedule, once it was complete we realized it was just the panacea we needed. With a tangible version of the game that could actually be played, internal debates transitioned from theoretical discussions based solely on abstract concepts to concrete dialogue. The demo not only unified the vision and understanding of the game's direction across the entire development team, but it was also the first time that everyone could see exactly how the assets they worked on would function within the game. During the internal postmortem, many team members noted that the demo was what finally allowed them to truly realize and embrace the vision for FINAL FANTASY XIII.

Although a vertical slice is commonplace in Western development, this was never actually practiced with our teams unless there was a company requirement. In retrospect, the demo acted as our vertical slice, and its effectiveness was felt full force by each and every member of the team. This was an essential key learning point that affected how we approached game development moving forward.

2) CLARIFICATION OF ELEMENTS AND PROCESSES THROUGH DEVELOPING THE DEMO. The demo brought together all data, development of which was previously uncoordinated, clarifying many elements and significantly speeding up the process of determining the remaining specs.

Instead of crafting fully detailed assets that looked good from every angle, the team could gauge how much effort to put into each area of the project by keeping in mind exactly how the asset would be used in the game. This realization had an increase in the team's ability to assess priorities, and as a result, productivity increased as well. With a much better understanding of the overall workload, we increased our ability to construct highly efficient schedules; the new scheduling was so effective, we actually did not miss a milestone.

3) CREATING THE LOCATION MANAGER ROLE. Although the schedule was now working, we began to realize that we were unable to keep up with the sharing of information within the traditional team structure. In order to resolve this issue, we created a new role that did not exist in our traditional development environment: the location manager, who would function to bridge the gap between different departments. The location managers were put in charge of specific in-game locations, overseeing and making adjustments to everything from cutscenes to battle placement; their position was similar to that of the lead level designer. Not only did the information flow improve on a location-based level, team members looking to lead projects in the future were able to hone their skills. The process relied heavily on the skills of individual location managers, so there were definitely ups and downs in the quality of the end results. Also, because these managers did not have discretionary authority, at times they were hindered because they could not make decisions on the spot. There is no doubt, however, that the location manager role had a positive effect on the project overall.

4) RESOLVING THE UNIVERSAL ENGINE DILEMMA. The issue with the universal engine was seen as something that would affect the progress of all related projects within the company, and in the end, it was decided that the needs of the flagship title, FINAL FANTASY XIII, should come first and foremost.

Once this was settled, the project and tool development teams were able to work very closely, and it became much easier to determine the specs on the project-side of things. Tool development began to pick up pace around the time when the game's core engine was around 70 percent complete.

5) NARROWING DOWN POLISHING POINTS THROUGH FOCUS GROUPS. Through the focus groups we conducted (mentioned in the "wrong" section), we found that, contrary to expectations, the game was received very well by Western players. Also, both Japanese and Western players placed emphasis on the story and battles, meaning that the style we focused on with FINAL FANTASY XIII was accepted after all. With this, we gained confidence that the game could stand its ground overseas as well. Now that the development team had obtained knowledge based on actual player responses, the desire and motivation to modify the game increased. Up until this point, development had been based solely on personal views of what was right or what was perceived as common knowledge.

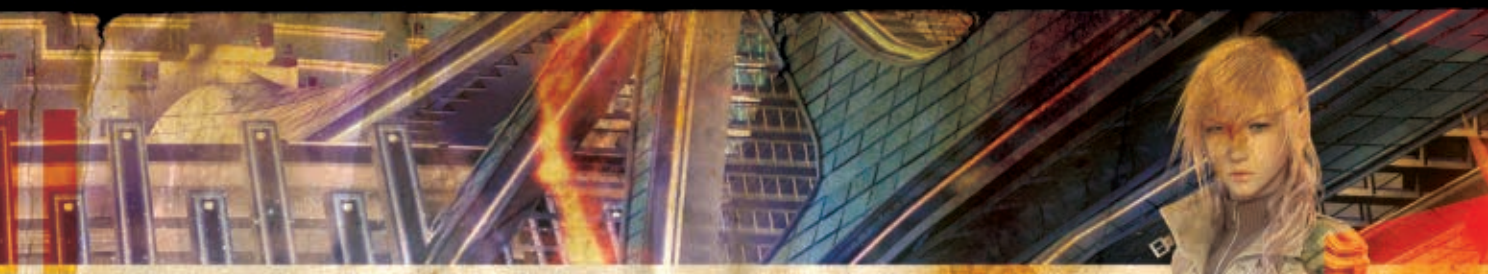
Because it seemed that Western players were extremely conscious of the moment-to-moment experience in battles, the feedback and requests we received regarding the system were brought to the staff's attention as important polishing points, and were incorporated in the final product as much as was possible.

We gained a considerable amount of knowledge from the tests, and in the end, most of the team felt that, while things did not go perfectly, it was worthwhile. This experience led to discussions of how the knowledge gained could be utilized effectively for future projects.

WHAT CHANGED THE PROJECT?

Looking back, several issues stand out. Information was not shared adequately. There was a lack of communication. The specs were not clear. The concept was not clear. These were the biggest problems that plagued the game's development. The obvious solutions would be to hold meetings to discuss progress, standardize workflow, clarify team structures and communication routes, and to require documentation of everything. But would these actions truly have solved all of the problems? Perhaps temporarily, but they wouldn't have addressed the root issues.

Getting the universal engine issue settled and assigning location managers were definitely a plus, but what helped our project progress was



the existence of a tangible ROM, a ROM that we could actually see and play. While it was only a small portion of the game, it's because we were able to create something with the polish of the final product that we were able to overcome the difficulties of having to communicate concepts and theories that existed only in our heads. Finally, all team members could have discussions based on the content of the disc. As a result, not only were we able to see eye to eye at discussions, everyone was on the same page and had a clear understanding of what this game was aiming to achieve. A bit late in the game, but I experienced firsthand the importance of developing the vertical slice as a key milestone. Western developers were not doing anything special or out of the ordinary, as had previously been perceived. They were simply executing a necessity, out of common sense. If we had been able to reach this understanding earlier, many of the issues presented in this project would have been resolved much sooner.

FANTASY FORWARD

Final Fantasy XIII overcame numerous difficulties on its way to becoming a finished product. Development following the trial version was extremely smooth, especially in the final year of the project, during which we were able to save a lot of time by localizing the overseas versions as the Japanese version was being completed. The character animations that portray detailed emotion, the high-definition visuals with beautifully vivid scenery, the speedy battle system, and the gripping storyline were all very well received worldwide, with the sales figures in Japan and overseas on just about equal standing. The latest update is that we have shipped over 5.8 million copies globally, marking this project as a great success.

The conclusion to this postmortem is very simple. I learned that we must first create something tangible and playable to share a game's concept and confirm the actual specifications to create an environment in which precise decisions function within the process. Only then can you proceed with the development of such immense amounts of data. Furthermore, up until this point, we had taken a very traditionally Japanese "Square Enix method" based on individual craftsmanship. Now we are trying to incorporate as much as possible from the development styles of studios overseas into our system.

Moving forward, the Final Fantasy development teams will utilize an effective approach that will only become more efficient over time and continue to deliver new and exciting fantasies to the world.

MOTOMU TORIYAMA is the director and scenario writer for Final Fantasy XIII. In the past, he served as event planner for Final Fantasy VII, event director for Final Fantasy X, and director of Final Fantasy X-2. **AKIHIKO MAEDA** is in the project investment management division. In the past, he served as postmortem facilitator, event planner for Final Fantasy IX, and event planning co-director for Crisis Core: Final Fantasy VII.

AN INTERVIEW WITH PORTAL 2 PROJECT MANAGER ERIK JOHNSON

tag you're

BRANDON SHEFFIELD

PORTAL was one of those rare game experiences that took audiences by surprise. The simplicity of the interface—shooting portals onto various surfaces to traverse through levels—was striking. Layered onto that was the excellent story, mostly driven by the player's love-hate relationship with GLaDOS, the touchy artificial intelligence that managed the facility in which the game took place.

PORTAL was a mere three hours in duration, and many felt it was a perfectly defined experience. How does one take that and extrapolate it into a sequel? Valve absorbed many of the team members for the DigiPen student game TAG: THE POWER OF PAINT, using their ideas of painting different effects onto the game world in order to increase scope without over increasing complexity.

But could they really add complexity of design without detracting from the simplicity that made the original game unique? Project manager Erik Johnson tells us it's all about understanding what will be meaningful to players.

Brandon Sheffield: ***Now that a trailer has been released for PORTAL 2, the main thing I notice is there seems to be a lot of added complexity to the design in general. What was the thinking behind that?***

Erik Johnson: There are two parts to that. One is that the trailer, the one we're showing at Gamescom and at E3, implies a lot more complexity than exists immediately for a player that plays through the game. We are showing you toward the end of being trained on a particular element. The reason we're allowed to add a number of elements that didn't exist in PORTAL is because the game is a lot longer. We thought PORTAL was the right length for the number of things in the game, the pacing was good. We want to have that same kind of pacing in PORTAL 2, so the game ends up being a lot longer, but still brings people up on new things at the right speed.

BS: ***That was the sense that I was getting. You have these little bot guys now, flying around and talking to you. They seem like they have the potential to put more story in there than before. Is that their function?***

EJ: Yeah, definitely. PORTAL was just you and GLaDOS. She starts off as just a voice and is the tormentor of your existence. The personality spheres are definitely this new character in the game—different than a character in HALF-LIFE 2 that is all about expression, and how they look. This is more or less a story delivery type of character. The reaction people have had to the personality spheres has been a lot stronger than we've expected, so that's good.

BS: ***Those personality spheres existed in the final boss battle of PORTAL. At the time, was there an intention of bringing them back in PORTAL 2?***

EJ: No.

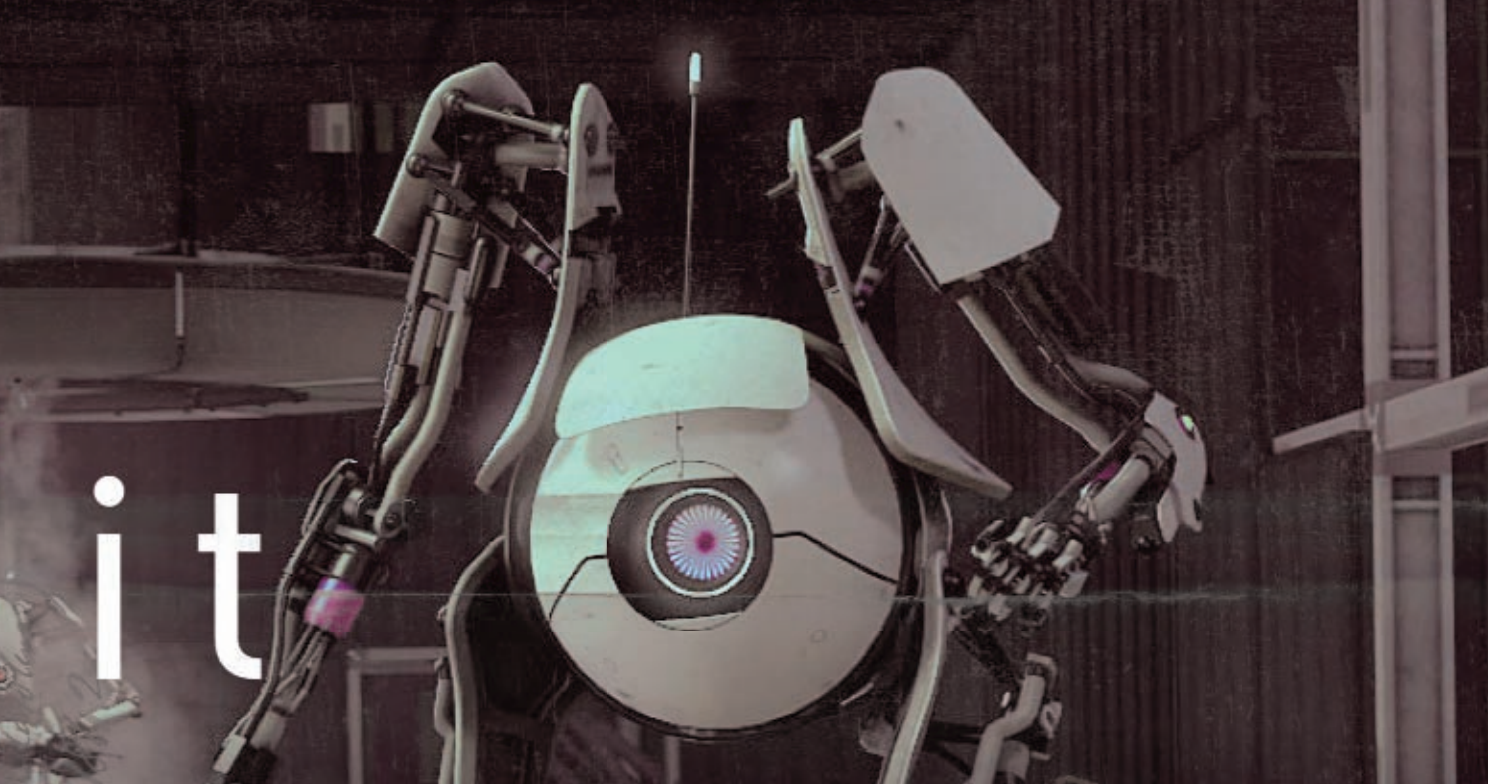
BS: ***Something Valve does pretty well is to take things that sort of existed in a previous game and flesh that out in a sequel or related product, which makes it feel like it was planned all along. A lot of games try to do that, but they tend to be as simple as "let's just take this NPC and make him the star of this game." It doesn't feel as well integrated. It's a big question, but how do you go back and retrofit in a way that makes sense in the universe?***

EJ: First, the reason why we do it—especially in PORTAL, there are a bunch of fans of the product already that have very strong opinions about the kind of game it should be. In general, we try to be the servants of their opinion. We try to build the kind of game that they want, and one of the ways to engage with customers is to point out knowledge that they have, like, "Hey, we know that you guys played PORTAL," to give them something to hold on to. And you definitely want to approach all pieces of the game, from story, the way it looks, to how the characters act in terms of this coherent universe that you can fit things into. A good application of that thinking would make it so that if somebody came up with a given idea, it would be really easy to determine if it would or wouldn't fit. I think PORTAL has done well in that regard because it is relatively simple in terms of that. And a lot of it is long-term community development to be able do those sorts of things.

BS: ***PORTAL was a game for which it felt as though a sequel never needed to be made, really. It's the kind of thing where people want more, but a sequel would feel like too much. How do you balance that expectation within yourselves and within your fans?***

EJ: The first thing we did was judge fans by their reaction, and partly because PORTAL was a much smaller game, they were saying they wanted more, but what you are saying is really accurate too; for many people, it was this perfect experience. It was the game that, far and away, more people finished than any game we've made; we can see in Steam if the game gets finished, and it was huge in that respect.

We looked back to find the core things players liked about PORTAL. We felt it was the story and the tone, the type of story it was, and the delivery mechanism of the story. We felt like, for a lot of people, their reaction was surprise about the gameplay. Portals are obviously a huge part of the gameplay itself, but the thing they wanted was to be surprised. Then [they were engaged by] what they thought when they played the game, and also the music. [Ending theme] "Still Alive" is something that people have a really



strong connection to. We looked at those three things and said, "Okay, inside of the PORTAL world, what can we do on those axes to create something that people want?"

BS: ***In this game, you can affect fluid, and use it to change the level environment. What would you say was the decision behind having that be an environmental effect versus something that you actually shoot out, like you do in the original TAG: THE POWER OF PAINT?***

EJ: Most of it was just playtesting. We had lots of different approaches on how to change the state of a surface, and this was the one that ended up fitting the best.

BS: ***Did you prototype different kinds of implementations to see if they would work?***

EJ: Yeah, the player shooting it, lots of different types of surfaces.

BS: ***To me, it seems that having to shoot anything other than portals would probably add too much complexity.***

EJ: There are a lot of advantages of having a game where the gun has the number of states that the portal gun has, especially in terms of players that don't play a huge number of games. It is a great interface with the world that always acts the same way.

BS: ***PORTAL was great as a single-player experience. I like these kinds of games a lot, but many companies are really avoiding it because of piracy, for one thing—Steam doesn't really have that problem—but there's that consideration that there's also longevity of gameplay and monetizing customers over the long term with microtransactions and things like this. How viable is the single-player experience going to be, going forward, for projects that have an actual budget?***

EJ: We also have two-player co-op in PORTAL 2, but I think there is an interesting question in how many projects should be offline products and how long that is going to be viable. HALF-LIFE 1 was a really offline product. I think customers want to find ways to talk about the thing they are a big fan of with other people, and ideally experience it the same way.

That doesn't mean every game needs to be multiplayer. With single-player games that were completely in a box, with no way to experience anything else, I think there are things that customers want that those games don't take advantage of. That could just mean that you want to be able to chat with other people who are playing through the same part of the game as you, or the fans can write commentary nodes in the game and everyone can experience those to take advantage of the fact that there is a huge community of people that want to interact with each other. I still think the analysis that every product needs to have competitive multiplayer, or be an MMO is incorrect; there are a lot of people who want an experience without the stress, so I don't see that changing.

BS: ***Software sales seem to indicate that the number of people that want to have a guided single-player experience that is completely offline is dwindling, and it's disheartening to me. But looking at who is buying and playing what, that is definitely what is happening, and the concern for me is that those kinds of experiences will not really improve because the people that can make the best games will not get the budget to make them.***

EJ: Part of it is thinking through the reasons for making decisions. You brought up piracy being a reason to not do single-player, which I think is a pretty crazy analysis on an issue like that; that's making a decision for your customers about the types of products you are going to build without, by definition, including your customers in that at all. They're saying that because of these pirates, you get no single-player experiences, which makes no sense to me. If there are as many players that want single player-experiences, you should go build that. I think there are plenty of people that still want to have single-player experiences; look at MARIO, those games do really well.

BS: ***True, but I feel like those experiences, for adults, are already rare, and will continue to become more rare. There's HEAVY RAIN, which was an attempt in that direction, but it's difficult to justify those unless the developer can fund a lot of it themselves. Aside from HEAVY RAIN selling okay, there is not a huge precedent for that, which is too bad. I recently saw a talk at GDC Europe where the creative director of Blue Point talked about SETTLERS ONLINE. He's been a designer for around 20 years, and it's really on my brain right now because his entire talk was, "We have to exploit human weakness in order to monetize people. We can't let them know they are being exploited, but that's what we do." The "classic game industry," as he called it, which is what you are working in because you're not making people pay to level up and stuff, may some day fall by the wayside.***

EJ: One thing to think about is, when we are building a game like HALF-LIFE 2 or PORTAL, monetization is a separate thing that, in the context of the game design, doesn't make a huge amount of sense, really. We are trying to exploit the psychology of the people that play our games all the time. We are trying to change their emotional state, and trying to predict what their emotional state will be based on what we are doing in the game world. That's compelling for people, like, "Hey they're getting a huge reward here, they are going to be happy. They are going to be challenged on the skills that we taught them here and that's going to be rewarding them." There is a non-customer-hostile way to think about what we are doing. There are hostile ways too though!

REVIEW BY ALI TEZEL

AUTODESK SOFTIMAGE 2011

SOFTIMAGE 2011 IS THE THIRD release of the software under the Autodesk banner since the company bought it two years ago. At the time of its acquisition, CG forums were full of speculation that the days of Softimage were numbered and that Autodesk was going to kill it because it competed directly with Max and Maya. Three releases under Autodesk later, those fears proved to be false.

In fact, Softimage 2011 is the best release of the software since the ICE (Interactive Creative Environment) was introduced back in version 7. Because Softimage 2011 came out months ago, the main user base has already made their decision whether to upgrade. I will assume that whoever is reading this review is a potential new user who knows very little or nothing about Softimage. So let's find out if this new release is worth your time to check out.

WHAT'S NEW?

>> Just like Maya 2011, Softimage 2011 only comes in one flavor—Softimage Advanced is no more. Now you get the whole feature set for the cost of Essentials. The only difference is on the licensing side where network licensing gives you five batch render licenses and standalone licensing doesn't.

A lot of work has been done to increase the performance of Softimage, especially in the viewport area. I want to stress this because Performance Increase bullet points on the back of the box usually don't impress and are frequently just one of the things marketing puts there with every release whether it is true or not.

However, it certainly is true here. Softimage 2011 has exceptional viewport performance even with low-cost consumer video cards. This is one of the most important features for me as an animator, if not the most important, as nothing kills creativity faster than a sluggish viewport when you are on a roll or facing a deadline. For comparison, in Softimage 2011, a fully rigged model of around 30–40 thousand polygons full of constraints and expressions runs at 100+ frames per second (fps) on my computer with an Nvidia GTX 275 video card, whereas it only ran around 30–40 fps in the previous Softimage 2010 version. This makes a huge difference if you are working on a scene with multiple characters.

ICE KINEMATICS

>> ICE Kinematics is the main course as far as new features go. If you are unfamiliar with ICE, it is the visual node-based programming system available in Softimage. Instead of writing code, you visually build your code using nodes. Everything you build is fully multithreaded and can be packaged and reused with different scenes and projects in your pipeline, or even shared over the internet for others to use. The biggest advantage comes from the fact that you are always getting interactive visual feedback on what you are doing in ICE, since it is

Shaders can be connected in a drag-and-drop workflow within Softimage 2011's Render Tree.

compiled in real time and includes great performance monitoring tools that let you pinpoint what nodes in your ICE tree are drawing the most system resources.

Prior to this version, ICE only let you modify point clouds and do geometry deformations, so it was mainly used as a replacement for Softimage's old particle system, which was showing its age. Now with ICE kinematics, technical directors can create very light and fast rigs. Since ICE rigs are composed of only the manipulators and the deformers, you are not required to create the traditional bone rig and can instead let Softimage calculate deformer transformations directly from the manipulators.

It certainly is a new way of working, and you will need to put in some time to come to grips with it. I would like to make it clear that artists with no programming experience shouldn't expect to dive in and build rigs with ease, as it gets very complex very fast. But if you put the time in, you are rewarded with super lightweight rigs that run very fast and are reusable. The problem with ICE right now is that the documentation and training is very limited. The example files are very basic and yet hard to decode. All the example rigs are pretty much unusable from an animator friendliness standpoint, so you will need to figure it out on your own instead of relying on what Softimage provides you for training. I recommend that you go online and check out what the Softimage community has been doing with ICE to get a better idea and learn from clearer examples.

FACE ROBOT

>> Face Robot was famous when it was first released, though more for its incredulous price tag of $100,000 than its features. The first version was quite slow to use, and the results were not worth the extra complexity it added to the pipeline. Times have changed, however, and it is now included in Softimage, but it also runs much faster and is more stable.

Face Robot helps in the rigging and animation of humanoid faces. Switch to the Face Robot interface in Softimage and go into a picking session to define the areas of the face, such as the eyes, nose, and so forth, and it will create a facial animation rig that you can then drive with mocap or key frame animation.

New in Softimage 2011 is the ability to create automated lip sync from audio files. Face Robot recognizes the phonemes and where they occur in the audio file, and drives the facial animation with that. Once that is done, you can go in and fine-tune the animation.

In my experience, automated lip sync tools are more trouble than they're worth, but we have all been in productions where you simply don't have the time or budget to animate every character by hand. It is a good tool to have available in case you need it, and it works great for background characters.

Also worth noting is that once you have created the rig and animation in Face Robot, you can export your work to a game engine.

ANIMATION AND MODELING

>> Animation and modeling don't see much in terms of new features in this release. On the animation side, the only feature worth noting is the ability to choose whether the Fcurve handles get preserved while collapsing animation layers.

As for modeling, according to Autodesk, the Booleans are much improved in terms of speed, but I didn't notice any speed difference compared to the older versions in my tests. A welcome new feature in modeling is how Softimage handles internal edges in polygons. When you symmetrize polygons, it now mirrors internal edges, and inverting polygons no longer flips them.

For a professional animation package, there is some functionality missing that should have been taken care of long ago. For example, it still does not have editable viewport motion paths for your objects and controls as in 3ds Max.

Modeling tools also remain untouched since many releases ago. If you are used to specialized modeling tools like those found in Luxology's Modo, you might find Softimage somewhat lacking in the modeling department.

TEXTURING AND RENDERING

>> New features in texturing include being able to set non-editable UV maps. This helps prevent accidentally modifying a UV set when you are working with multiple sets. Copy and paste of UVs has been improved and now works better with symmetric copies of meshes and with models where the UVs have been re-indexed. The Unfold projection is improved as well. There are several new options in the Unfold properties that help you unfold better UVs from symmetrical models, along with numerous bug fixes for the Unfold tool. RenderMap and Ultimapper now support inclusive and exclusive lights for your texture and lighting baking needs.

On the rendering side, Softimage 2011 integrates the new version of Mental Ray 3.8 for speed improvements. Sadly, the real-time GPU renderer iRay is not included (though it does not appear in Maya 2011 or 3ds Max 2011 either). As of this writing, Autodesk announced that they have acquired Illuminate Labs, maker of the Turtle Renderer, which is a great lighting and baking solution for games. According to official statements, Autodesk plans to incorporate Turtle in future offerings. We can hopefully expect to see it in the 2012 suite of Autodesk products.

Softimage now exposes about 200 new shaders and includes new lighting tools, as well as support for the IES lighting format and raytraced soft shadows. The ability to embed scene information within renders and viewports with their render and camera slate, and the added ability to render from multiple cameras in the same pass, can save quite a bit of time.

For anyone developing their own shaders, including real-time shaders, architectural changes have been made so that custom UI work no longer has to be done to get the shaders operating inside Softimage.

You can also integrate your own effects files or author new effects directly within Softimage using the real-time shader wizard.

TRY IT YOURSELF

>> Softimage 2011 is a good direction for the software. The developers are finally building on top of the great framework they created back in version 7 when the core rewrite gave us ICE. It also manages to fit in your pipeline rather than replace it, thanks to a wealth of connection features with Maya and Max.

That is not to say it is not without drawbacks, the main one being the lack of training and third-party support. It is very easy to get up to speed with Maya and Max thanks to the wealth of training available for them online and offline, but the plug-in and free scripts available for Softimage are nowhere near what is available for Autodesk's other products. However, the company has been working toward opening the software to more developers by expanding on the SDK, so hopefully we will start seeing more third-party support for the software in the future. At this point, a 30-day trial is better than a 30-page review, so I would certainly recommend that you download the Softimage trial from Autodesk (www.autodesk.com/softimagetrial) and experience it firsthand.

AUTODESK SOFTIMAGE 2011

Autodesk, Inc.
111 McInnis Parkway
San Rafael, CA 94903
http://usa.autodesk.com

PRICE

$2,995

SYSTEM REQUIREMENTS

Microsoft Windows 7, Windows Vista Business (SP2), or Windows XP Professional (SP2). Intel Pentium D processor (Intel or AMD dual quad core processor recommended). Qualified hardware-accelerated OpenGL 1.5 (2.0 and higher recommended) graphics card. DirectX 9.0c application programming interface and higher.

PROS

1. ICE Kinematics offers great flexibility and performance.
2. Excellent viewport performance, even with heavy rigs and models.
3. Face Robot is a timesaver for small studios.

CONS

1. Modeling tools are lacking compared to the competition.
2. Lack of third-party support compared to other Autodesk products.
3. Animation tools can be improved.

ALI TEZEL *is an animator at Image-Engine in Vancouver with over five years of experience in the feature film, broadcast, and games industries.*

SKIN RETARGETING

AN EFFICIENT PATHWAY FOR LIMITLESS CHARACTER FEATURE CUSTOMIZATION

THE ABILITY FOR USERS TO tweak the appearance of their avatar has been getting more and more popular in games, especially in social and party games. This allows players to create something that stands out from the crowd, and gives them a sense of ownership over their characters. The depth of this customization can vary greatly between titles and can include elements such as unique voices, animation styles, and outfits. In this article, we'll focus on how to maximize customization of more nuanced physical features, such as ear prominence or lower lip size, while minimizing impact on system resources.

EXISTING APPROACHES

>> One traditional approach to tweaking the features of a character has been morph targets. Since each tweakable feature then requires a separate copy of the target mesh (or at least a subset of it), the memory footprint can quickly balloon out of control. Also, any time a vertex position is modified in the target mesh's source asset, it needs to be mirrored in all its associated morph target source assets.

Another approach is to just add new bones to the rig that can be transformed to achieve any tweaks made to physical features. Since these bones are only used to control the character's base appearance and will never animate during gameplay, it's just plain wasteful to include them in the character's in-game rig. Depending on how the animation and skinning pipelines are designed, adding a large number of bones can also introduce a number of runtime inefficiencies.

To avoid the pitfalls inherent to both of the aforementioned approaches, I have implemented a process called "skin retargeting" that facilitates high-quality results at a fraction of the resource cost, all while allowing for rapid asset iteration.

CONCEPT

>> Skin retargeting is a process through which a skinned mesh is transferred from one skeletal rig to another while preserving its general topology. It allows us to take a mesh that has been skinned to a complex, highly customized rig and move it to a much simpler rig that will be used during gameplay. The complex rig contains many bones that aren't present in the gameplay rig and is used to apply localized deformations to a base skinned mesh. These deformations then get baked back in to the base mesh that gets used during gameplay.

For example, say you wanted to be able to give elf ears to any existing character in your game. Not the same elf ears, either; they need to vary in length, width, shape, and prominence (angle from the head) depending on some user-defined attributes. Adding a few ear bones to every character and assigning them transforms to be used during skinning would definitely do the trick. Unfortunately, this is likely to eat into the bone budget and cause a number of other issues, especially if requested late in development. It's also wasteful, since the ears never actually need to animate during gameplay. To solve this problem using skin retargeting, a new rig is created with those additional ear bones. That more complex rig is then used to translate, scale, and rotate the ears into their desired shapes, which are then transferred back to the base mesh for use in-game on a rig without any ear bones.

It's important to note that, even though the technique I describe assumes the application performs vertex skinning on the CPU, there's no reason it couldn't be expanded to utilize vertex textures generated by GPU skinning.

ASSETS

>> One of the keys to achieving high-quality results with skin retargeting is the careful layout of the deform skeletal rig. This rig contains all the bones to be targeted with physique-modifying transforms and is typically an extension of the standard in-game skeletal rig it is paired with. It's important that any bones unique to the deform rig are positioned as leaves, or leaf branches, in the skeletal hierarchy. This ensures that the skinned mesh topology will be preserved when applied to an animated in-game rig after retargeting.

The other key asset information we require lies within the mesh's deform-skinning data. We want to be able to take an in-game mesh and alternately skin it to either the standard or deform rigs. There are a couple different approaches we could take here

LISTING 1

```
{
desc="Ear Prominence"
bones=[
{
bone=Ear_Base_Right
Rotation={ from=(0.0,0.0,5.0) to =
(20.0,0.0,-60.0) }
}]
 }
 {
desc="Ear Size"
bones=[
{
bone=Ear_Base_Right
scaling={ from=-0.1 to=0.2  }
}]
 }
 {
desc="Ear Shape"
bones=[
{
bone=Ear_Shape_Right
translation={ from=(0.0,0.0,0.002) to =
(0.0,0.0,-0.008) }
}]
 }
 {
desc="Ear Tip"
bones=[
{
bone=Ear_Tip_Right
translation={ from=(0.0,0.0,0.0) to =
(0.0,0.0,-0.015)  }
}]
 }
 {
desc="Earlobe Size"
bones=[
{
bone=Ear_Lobe_Right
scaling={ from=0.0 to=0.5  }
}]
 }
 {
desc="Earlobe Length"
bones=[
{
bone=Ear_Lobe_Right
translation={ from=(-0.0025,-0.01,-0.005)
to = (0.0,0.0,0.0) }
}]
 }
```

depending on how the existing skinned vertex data is laid out. The bone-space positions and bone/weight mappings used for the deform skeleton could reside in a separate vertex stream, or they could be used to generate an entirely new mesh asset. It will be safe to omit colors, UVs, and so forth from this data, since the direct results of skinning to the deform rig will never actually be displayed on-screen.

The number of vertices in the in-game and deform meshes must be identical for the process to work correctly. This also means that for each vertex in the in-game mesh data, there is exactly one corresponding vertex in the deform mesh data. These vertex pairs must be spatially equivalent to each other when transformed in to their default (T-pose) model spaces to prevent skin retargeting artifacts. For the purpose of this article I will assume that all pre-skinned vertex data will be provided to the game in bone-local space.

If your data build step is performing any sort of vertex re-ordering, perhaps as a cache optimization, this will need to be accounted for. You can take advantage of the fact that the deform mesh data will never be displayed on screen and can repurpose this step. When vertices are re-ordered in the in-game mesh data, that can produce a mapping that the deform mesh will use to perform an identical re-ordering on its own vertices. This will help simplify the runtime process by allowing for the assumption that given any i^{th} in-game vertex data (v_i^g) its corresponding deform vertex data will always be (v_i^d).

To get a better idea of how the deform rig and skin data are set up, let's revisit the elf ears example. We start by creating a deform rig that's identical to the standard in-game rig. To achieve the range of desired ear shapes, we'll need to add four new bones on each side of the head: an "ear base [left/right]" bone parented to the existing "head bone," an "ear shape [left/right]" bone parented to the "ear base [left/right]," an "ear tip [left/right]" bone parented to the "ear shape [left/right]," and an "ear lobe [left/right]" bone parented to the "ear shape [left/right]" (see Figure 1).

Next, we'll need to create a set of skinning data that maps and weights the ear vertices to these new deform bones. The version of the ears' skinning data that will be used in-game should still be weighted to only the head bone.

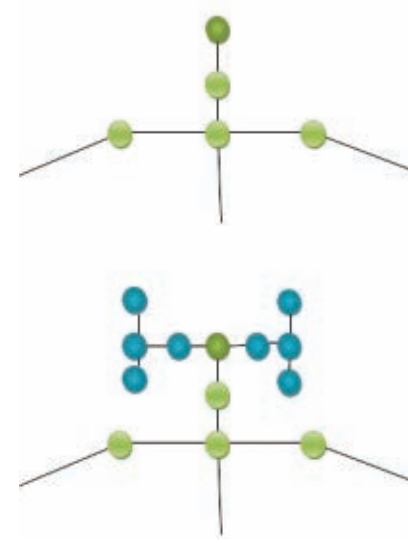


FIGURE 1 A view of the upper torso area of the in-game skeletal rig with the "head bone" in a darker shade of green (Top). A view of the upper torso area of the deform skeletal rig with the new deform ear bones colored blue (Bottom).

PROCEDURE

>> The skin retargeting procedure (see Figure 2) is responsible for actually transferring any changes in topology from the deform skinned mesh to the in-game skinned mesh. It can be performed as an offline asset preparation step, but the greatest benefits will be seen when it's integrated as a runtime process. Due to the added cost, it's probably not something you'll want to run during performance-critical gameplay, but instead as an automated step of character loading or through a dedicated character-tweaking UI.

We start by applying transforms to the deform skeletal rig to achieve the desired physical modifications (this step is explained further in the next section). Next, the mesh is skinned to the deform rig using the appropriate vertex data to produce a model space version of the tweaked mesh. Below is the standard skinning equation for transforming a deform bone space vertex position (v_{pos}^d) to model-space (v'^d_{pos}), where n is the number of deform bones influencing the vertex, w_i^d is the i^{th} deform weight, and m_i^d is the i^{th} deform bone matrix.

$$v'^d_{pos} = v^d_{pos} \sum_{i=0}^{n-1} \left(w_i^d m_i^d \right)$$

Every model-space vertex that was just computed is then transformed back in to bone-local space using the bone mapping/weights associated with the in-game rig. Below is the equation for transforming a model-space deform vertex position (v'^d_{pos}) back to bone-space (v^g_{pos}), where m is the number of bones from the in-game rig influencing the vertex, w_i^g is the i^{th} weight from the in-game rig, and m_i^g is the i^{th} bone matrix from the in-game rig.

$$v^g_{pos} = v'^d_{pos} \sum_{i=0}^{m-1} \left(w_i^g m_i^g \right)^{-1}$$

These transformed vertices (v^g_{pos}) are the ones that will be saved off and used as the source mesh data for skinning during gameplay. In addition to vertex positions, this process should be performed on any normal, bi-normal, or tangent values present in the vertex data to ensure correct lighting is calculated when the mesh is rendered in-game, though it's probably not necessary if all topology changes are relatively minor.

It's worth noting that if the bone matrices (m_i^d or m_i^g) have not undergone any additional transforms prior to skin retargeting, there should be no change in the in-game vertex data after this

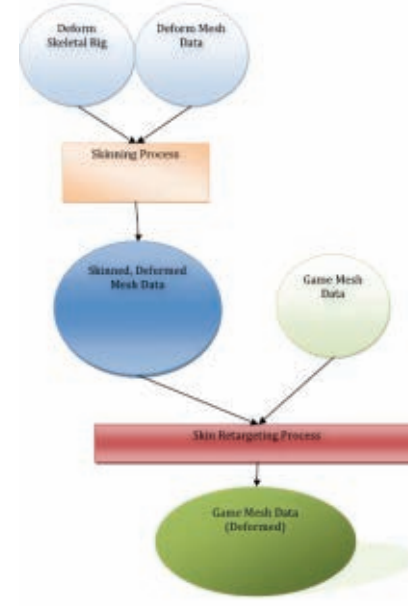


FIGURE 2 A diagram of the runtime skin retargeting procedure.

process is applied. Below is the equation expressing this identity for a single in-game/deform vertex pair (v_{pos}^{g} and v_{pos}^{d}).

$$v_{pos}^{g} \sum_{i=0}^{m-1} \left(w_{0_i}{}^{g} m_{0_i}{}^{g} \right) = v_{pos}^{d} \sum_{i=0}^{n-1} \left(w_{0_i}{}^{d} m_{0_i}{}^{d} \right)$$

Coding up this equivalence statement can prove useful in verifying all incoming assets that will undergo skin retargeting.

Another way of viewing skin retargeting is as a sort of "reverse skinning" process, where the transforms used to skin and "un-skin" the vertex data may be different. It's likely that most popular modeling tools, such as 3ds Max, use similar algorithms internally when geometries are applied or transferred to a set of hierarchical transforms.

FEATURE MODIFICATIONS

>> It should now be apparent that all mesh features modified via skin retargeting are controlled through transforms to bones in the deform skeletal rig. Let's now explore how to interpret these bone transforms into something more useful and intuitive. Each bone can be translated, rotated, and scaled in all directions—in bone space and model space—to yield a variety of results, many of which will be jarringly unnatural. One approach to greatly reduce the possibility of visually displeasing results is to narrow down the ranges of these transforms and group them into more logical structures that correspond to well-known physical features. This way, any single tweakable physical feature can be described as a collection of bones, along with the limits imposed on their rotations, translations, and/or scaling in any direction. These feature definitions are tightly coupled with the layout of the deform rig, and so it is recommended that they be exposed to a skilled character artist to produce the best results. If you plan on exposing these features to be modified by an end user, normalizing the transform limits and mapping them to some UI control will do the trick nicely.

The character-loading process will also require a few changes to ensure that any saved modifications to physical features will be applied automatically. Before the character model is displayed for the first time, their set of normalized feature values should be used to transform bones on the deform rig, then feed that into the re-skinning process, and use the output as the new in-game character mesh.

To better illustrate how feature tweaking can be set up, let's once again return to the example of customizable elf ears. Listing 1 is an example of how we can describe the six anatomical features we're interested in, based on the bones we have available in the deform rig (limited to the right ear, for brevity).

Now we create a UI slider for each feature that the user can easily tweak to completely customize the look of his/her character for use in-game. While this UI is active, the skin retargeting system is constantly updating the deform rig based on the current feature slider positions, skinning the deform mesh, and then transferring the changes in topology back to the in-game mesh. This ensures real-time feedback and faster iteration when designing a unique set of ears. See Figure 3 for some examples of how these six distinct physical features can be tweaked to achieve very different results based on the values in the table below.

IN CONCLUSION

>> One could argue that a full skin retargeting system is a little overkill for elf ears alone. This may be the case, but its power lies in the potential to greatly expand the degree to which a user can customize all physical aspects of their character. This process was added to GUITAR HERO 5 early in development, and shortly after being placed in the hands of a very capable character artist, the user was provided with control of over 50 intuitive, tweakable features for the face alone. This allowed us to keep the number of bones used by characters during gameplay to a minimum while imposing no limit on the number of deform bones that could be used for altering the physique.

The memory overhead required by this feature was also kept low since the deform skeletal rig and skinning data were only required during well-defined parts of the game—when editing a character and when creating a character based on a saved preset—and were immediately discarded after use.

Although facial features are the most obvious application of skin retargeting, there's no reason it couldn't be expanded to include changes to biceps, breasts, stomachs, feet, calves, or even applied to features of completely non-human skinned meshes. With social and party games rapidly growing in popularity, this lightweight technique can serve as a valuable tool for empowering the user to customize their experience and help them stand out from their peers.

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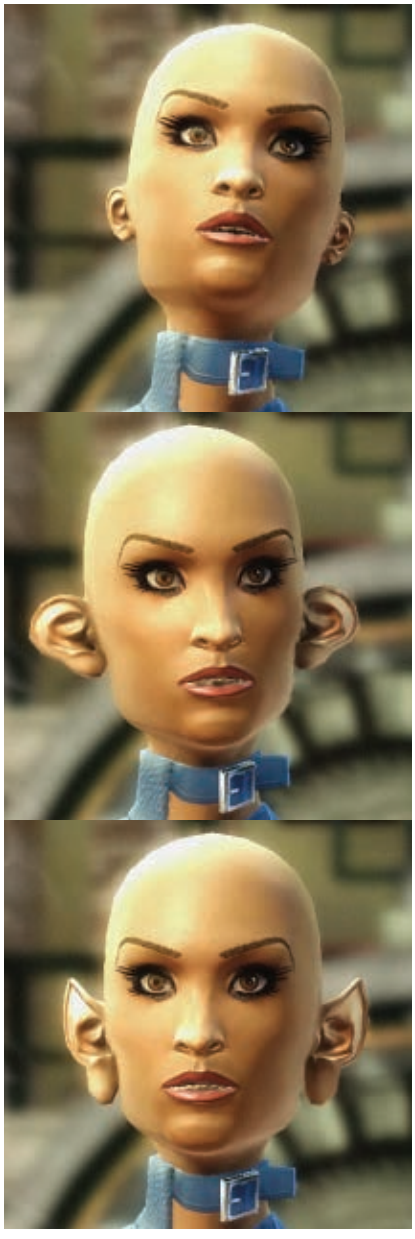

FIGURE 3 Three extreme examples of custom ears that can be generated by tweaking a small set of physical features (from the "Rocker Creator" in GUITAR HERO: WARRIORS OF ROCK).

	Image 1	Image 2	Image 3
Ear Prominence	0.25	1.0	0.5
Ear Size	0.1	1.0	1.0
Ear Shape	0.0	1.0	1.0
Ear Tip	0.0	0.0	1.0
Earlobe Size	0.0	1.0	0.0
Earlobe Length	0.0	0.0	1.0

MID LIFE CRISIS

WE'RE HALFWAY THROUGH THE CONSOLE CYCLE—WHAT DOES THIS MEAN FOR ARTISTS?

LET'S START OFF WITH A REALITY CHECK. The PlayStation 3 and Xbox 360 are now four and five years old, respectively. They are not the <expletive deleted> next generation of anything anymore. The "next-gen" label was a handy label back when we had to assimilate a big bundle of technologies (normal mapping, programmable shaders, and so on) in one big gulp. Now, though, it's just embarrassing, like all those products from the 1990s with "millennium" in the name. If we need a label, let's start calling them the "seventh generation" consoles. The presumptive replacements, Xbox 720 and PS4, will be "eighth generation consoles" when (if?) they materialize.

Whatever name you prefer, the consoles have been enormously popular. As of late June 2010, about 41 million Xbox 360s, 38 million PlayStation 3s, and over 70 million Wiis have been sold. During the last five years gaming has become a respectable mainstay of the entertainment business. On the other hand, the graphics advances of the PS3 and 360 came with a hefty price tag, which we've all felt firsthand, as teams and budgets have grown.

We're all familiar—probably too familiar—with the side effects of seventh-gen development bloat: bigger teams, more bureaucracy, nervous publishers afraid of taking creative risks, and the rapid rise of outsourcing. All those shiny, bumpy polygons have been a bit of a Devil's bargain for developers. It's not surprising, therefore, that a lot of developers have abandoned the mainstream AAA business for indie games, iPhones, and handhelds where teams are smaller, jobs are less regimented, and it's easier to feel personally invested in what you make. Even so, most of us are still tied to the console cycle. The hardware limits what we can accomplish—both artistically, and economically. For this reason, it's worth postulating what may happen for the remainder of this generation.

Speculation about the next "next-gen" consoles is already all over the Internet, but the console manufacturers have been very cagey about their intentions. Sony has spoken many times of the "10 year" console: the company can't help but like the idea, considering that the creaky old PS2 has sold nearly 140 million boxes since it appeared back in 1999. That's in the same ballpark as the 360, PS3, and Wii combined. Microsoft hasn't come clean about its plans, although Chris Lewis, Microsoft's European boss, was widely quoted this year as saying 2010 was "in many ways the mid-life cycle."

Leaving prognostications and exact dates to the fanboys and forum warriors, it's still safe to say that we're not seeing the end of the seventh generation any time soon.

THINNING ON TOP

>> What does it mean for the consoles to hit their mid life crisis? What's the console version of ulcers and regrets, or a hair weave and a new sports car?

The big fact about later-life consoles is that a lot of the mystery is dispelled. While graphics tech will continue to evolve, the mainstream consoles are not where radical innovations in graphics will happen. Ambitious graphics programmers and hot shot shader artists are going to be pushing the limits on PCs with the latest graphics cards, rather than elderly DX 9/10 parts in the 360 and the PS3. The slickest new graphics technologies

on the horizon, like realtime radiosity or realtime raytracing, are going to debut on bleeding-edge PCs. Moreover, we'd better be resigned to the fact that a lot of this wizardry will never be backported to the current consoles; there are a bunch of shader programming tricks in the new generation of DX 11 / Shader Model 4 hardware that will never be possible on current consoles. Moreover, the gap in available memory is now enormous: there are plenty of consumer cards with a gigabyte of onboard memory, and high end cards routinely come with 2 gigs, while the consoles oblige us to cram our worlds into 256 megs of video memory. Our consoles, which once seemed to be such monstrously beefy graphics machines, are now second-class citizens.

This might seem like a bad thing. So much of a game artist's life is about what we can't do. It can be galling to think of shoehorning our precious work into tiny memory slots on slow hardware when some lucky stiff is swimming in 2k textures and postpass effects. It's fun to play with the latest and greatest, but we can't all work for Crytek.

Paradoxically, though, falling behind in the technology race will actually be good for most console projects. Graphics competition is expensive and risky. It's hard enough to deliver never-before-seen shaders and effects. Building content and tools to support radical new effects often involves a lot of costly trial and error. New tricks often come with unexpected performance or content costs. How many of us have discovered late in a project that budgets have shifted radically because some new feature turned out to be a memory hog? How often have exciting new effects been relegated to painfully limited uses because they turned out slower than promised? Life on the frontier is full of painful uncertainty.

Now that the limits of the consoles are fairly well understood, we see less shoot-for-the-moon optimism and more sober estimates of the likely costs and benefits of any particular graphics feature. At this point in the console cycle, there are plenty of good examples of how to tackle common problems: if you're trying to imagine a feature, you can probably find a shipped game with something similar to measure your ambitions against. There are years of articles and GDC talks to explain how things were done and what the pitfalls were. With so much less uncertainty, the second half of the console cycle can be a lot more humane than the first. Fewer surprises, more realistic scheduling, and achievable graphics goals are good things.

MELLOW AGE

» The comforts of middle age aren't just for programmers and tech artists. Production folks have also learned a lot over the last few years. Most of us now know by heart all the tools and techniques that caused our teams to bloat so badly and our "next-gen" projects to flail. We're comfortable with modeling zillion-poly characters in ZBrush. We confidently cast our normal maps and ambient occlusion textures. We're able to work with shaders and MSAAA and a dozen other techno-buzzwords that few of us had heard of in the innocent days of fixed-function graphics. The cumbersome business of mapping high-res models onto reasonable game assets is helped along by new tools like TopoGun and 3dCoat. Occlusion mapping has been folded into the ordinary graphics workflow and no longer requires laborious workarounds. Shaders remain a dark art, but by now, most studios have a body of working knowledge and practical experience that renders them merely difficult rather than completely mystifying. In short, we're gradually becoming as efficient with all these new techniques as we used to be with low-poly modeling, hand-painted shading, and all the other tricks we used to pride ourselves on in the days of the PS2.

With the medium in a relatively stable place, there's time to concentrate on art rather than frantically racing to keep up with changes in technology. Look at the difference in quality between the games in the second wave of this console cycle and the pioneering titles from three or four years ago. To pick an example at random, compare a character shot from MASS EFFECT to a similar shot from MASS EFFECT 2. You can see how much crisper and more controlled the graphics in the second shot are—largely because the second game was a well understood problem, rather than a thrilling journey into the unknown. As the game's producer Casey Hudson recalled in an interview, "Having shipped the game on Unreal with a MASS EFFECT total framework in place, we looked at what our final performance memory budget was and billed MASS EFFECT 2 to that budget. We didn't have the opportunity to do that in the first game, so that helped us to better develop content."

The latter end of the console cycle is good for artists in another way as well. The perennial tug of war between graphics technology and artistic innovation tilted pretty heavily toward the technical side in the early days of this generation. With per-pixel shading, better lighting models, and HDR, the game industry's unhealthy obsession with photorealism reached a fever pitch. In these later days, when the best techniques are available to anybody who picks up a copy of *Graphics Gems*, it's harder to achieve a decisive advantage with technology alone. Strong visual design (e.g., games like LIMBO, FLOW, and NARUTO SHIPPUDEN) is a better way to distinguish your game than a startling shader effect. It might be too much to hope for, but it's at least possible that the bigger installed base and cheaper consoles will also support more daring choices and innovative new game styles.

THE GOLDEN YEARS

» If this all sounds very cheery, don't feel too relaxed. The Romans liked to quote the line, "*ars longa, vita brevis*": Life is short, but art endures. In our business, the life of a particular platform, technology or technique is finite, but the fundamental challenges remain the same. If the next couple of years give us a break on the technology side, we'll still have plenty to keep us busy. For the moment, though, enjoy the respite. It won't last.

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MASS EFFECT 2.

MAKE BETTER BOSSES

CHANGE YOUR BOSS BATTLE FROM A MISERABLE SLOG INTO AN EMOTIONAL HIGH

I'M A PRETTY MELLOW GUY FOR THE MOST PART. I'm relaxed and easygoing when it comes to design. But some things can make me go purple with rage. A recent prime example is boss fights that play as though they were designed as afterthoughts by otherwise capable and talented design teams.

I find it inconceivable that truly terrible boss fights still infect our games. You would think we'd be better at this by now. Our genre is now middle-aged—Pong is 40 years old, for Pete's sake. We've had decades to hone our skills and practice. And yet, I'm playing triple-A games with boss fights pulled straight out of amateur hour.

A poorly designed boss can cripple or kill a game. This is even more true in linear games that don't allow the unfortunate player to move on without finding some way past your design abomination. In such a scenario, stumped players have no choice but to reach for the strat guide, dial in the cheat codes, or quit playing altogether.

Disdain for crappy boss fights is not new. Some designers think that the idea of bosses is obsolete, and should ultimately suffer the same fate as the dinosaurs. I disagree—a well-tuned, well-balanced boss fight can provide an epic capstone to a chapter or game, and can help create an emotional flow through the gamespace that makes the entire experience more compelling. Great boss fights provide expansive, memorable game experiences that will often live with the player longer than grinding through the cannon fodder they had to defeat to get there.

Unfortunately, a lot of boss fights are still a long way from "great" or "epic," and lousy boss fights can kill a game. Too many design teams are still failing the basics. And so, written in the glint of my incandescent rage at game-that-shall-remain-nameless, here are a few things for designers to remember as they put together the ultimate showdowns in their own gaming experiences.

ILLUSTRATION BY JUAN RAMIREZ

SHOW ME MY PROGRESS

>> Recently, a frustrating boss encounter in a platformer had me so apoplectic with rage that I'm fairly certain a blood vessel in my brain was about to burst. My quick jaunt over to GameFaqs didn't help matters. Don't get me wrong—the guide was quite helpful. But my anger increased when it pointed out that the boss I was fighting was pretty much impervious to all my attacks, but quite susceptible to super secret special attack C. You know, the one I almost never use.

This all would have been fine—hey, I like trying new things—except that the game didn't tell me that. I, by the way, had tried using the specified attack and, near as I could tell, it made no difference. There was no health bar that marched down (or not) based on my attacks. No bits of armor fell off. No significantly different impact animations or reactions. No red flash, no flytext, no distinctly different cries of pain. Nothing. The only way to tell if you're succeeding is if your enemy falls over dead. The only way to tell if you're winning is to find out you've won.

This flies in the face of what video games do well. Video games as a media are magical because they are experiential—they are all about learning by doing. Players identify the gameplay pattern and continue to optimize it as the game throws new challenges at them. But when players have no feedback, they can't learn. They don't know if they're doing something utterly futile, or are within a cat's

whisker from utter victory. They might be doing absolutely the right thing, but get an unlucky streak and die without knowing how close they are. All this is a recipe for no fun. As mentioned in the "Hot Failure" article in the September 2010 issue of *Game Developer*, once a method has been tried and perceived as failed, it will take a long time for the player to come back around to that idea without direct feedback.

GET ME BACK TO THE FRAY

>> Okay, so your boss is special. He's cool, he's got some killer moves, he's nearly impossible, you're proud of him, and you want him to pound the player into pulp as frequently as possible, for as long as it takes for the player to reverse engineer whatever half-baked puzzle you have in your head. Fair enough. But if you do, stop and ask yourself, does failing suck in your encounter?

It's almost impossible to believe, but decades after the birth of the platformer, we still have games that insist on throwing you to a distant save point if you die. Or those who don't allow the player to replenish his health and energy before getting stomped a second time. Or worse, save points inside of locked doors where the player who stumbles into the boss fight at half health can no longer get back out to find a med pack and heal up.

And then there's the absolute worst: the rare gem of a game that gives me painfully long load times between fight attempts.

Then let's talk VO. No matter how great the narrative or witty the dialogue, not even the sharpest one-liners can survive the repetition of being heard 30 times in a row—especially when compounded with the frustration and humiliation that comes with repeated failure. If you can't put the save point after the cinematic, at least be sure it can be skipped. (See: "Look at all that juice" in GEARS OF WAR.)

TEACH ME HOW TO BEAT THE BOSS

>> Players have a tendency to fall into a rut. It's all good and well for the designer to want to break the player out of predictable, rote patterns, but utterly changing the game on him will almost always backfire. This is more common than you'd think. Examples I've seen include introducing jumping elements in a game that previously had none, changing the timing of the player's attacks, making him fight on a horse he's never ridden before, giving him all-new skillsets to learn, or even remapping the player's controls.

One game I played threw an underwater boss at the player before they had ever done any other swimming. This left the player with no choice but to learn a difficult and confusing boss creature while simultaneously attempting to master moving and handling an avatar and a camera in full 3D—that latter feat alone can overwhelm many players.

The solution is simple: if the designers were set on this boss, the game should have thrown a longer swimming level at the player with lots of easily squashable grunts to allow them to practice and gain confidence in the new environment. This solution works for nearly any of the complex abilities I outlined above. Want the player to experience a boss battle that remaps his controls and makes him whistle Dixie into the microphone while balancing on a Wii Fit board? Fine, but first give him a miniboss with a similar ability so the player can learn these skills in a relatively comfortable and non-threatening environment.

MAKE THE FIGHTS INTERESTING

>> Good boss fights make the player feel smart or skilled, if not both. They make the player feel like they're applying what they've learned. The puzzle inherent in a boss fight should flow naturally from the existing, well-established mechanics of the game. While players should feel like they can bring their existing skills to the task at hand, they should also feel like a suitable challenge has been placed in front of them. Boss fights that wander too far from the core game mechanics often feel out of place or clunky, often because all-new mechanics are not as well thought-out, balanced, or polished as the core mechanics.

On the other end of the spectrum, the most common way to make a boss is just to throw a gazillion hit points on it and see if the player can outlast it. MMO zealots derisively call these fights "tank and spanks." To a designer, such simple fights have a use—they help introduce players to unique concepts of boss fights (in the case of MMOs, tanking and healing)—but for the most part, they are generally regarded as utterly lacking in design imagination.

Great boss fights aren't just stat-boosted bags of hit points. They're impressive in scale and scope, often with tailored intros, interesting VO, and unique special attacks. They need to provide an interesting but somewhat transparent puzzle, which might require an investment in AI, combat mechanics, and possibly even user interface. To give your boss fight the emotional high point you want in your game, it needs to bring a little pomp and circumstance before offering a worthy challenge to the jaded player to not just feel like a showy speed bump.

MAKE BEATABLE FIGHTS

>> Can your big bad boss be defeated by mortal men? Too many are just way too hard, depend too much on luck or serendipity, or on the digital agility of a virtuoso. If a decent FPS player can't get past your boss, even after reading the Prima strat guide and watching YouTube videos of the finer details, what hope does Mr. Casual have?

It takes discipline for designers to remember that they are uniquely skilled with their own game controls and GUIs, and uniquely aware of the depths of the mechanics. They need to remember that not everyone has been playing the game nonstop for the full length of a three-year development cycle. One cannot let one's own familiarity with the game skew the idea of "hard."

Even beyond this, there are a number of variables that can create wild variance in boss difficulty, even if the players themselves are competent. An encounter that is trivial on a PC might be nearly impossible on a console controller, due to the difference in precision and camera control. A boss fight with a bigger light show than Dick Clark's New Year's Eve party might bring a laptop to a crawl, and kill the player with bad performance. And don't make a boss fight require a tactical nuke if you can't be reasonably sure the player's got one in his pocket.

Having a lot of character creation options, such as class choices or weapon loadout restrictions, can be particularly problematic. If you allow low or non-combat roles such as stealth, healing, or diplomacy, then you need to ensure that players who choose these classes feel like their choices are respected and validated, but you can't weaken the boss to favor them so much that it invalidates the player who has chosen the path of the bloodthirsty savage. This gets even trickier in free-form character building systems, where designers have no guarantees as far as what combinations of powers the player will bring to the fight, but need to allow the player to finish the game with any they have chosen.

One more thing: if you do have an open world game, and you let me go level up some more after your boss thrashes me, don't level up that boss to match my new level. Nothing will make adventuring in the open world experience feel more futile.

WANNA MAKE SOMETHING OF IT?

>> Why are so many boss fights in games still miserable? I suspect it's heavily a process question: bosses tend to be complex, and arrive later in the development cycle. They have to come later in the schedule than the basic combat and advancement system, so are integrated into the game late. The later they show up in the game, the fewer QA cycles they get.

If you believe that boss fights are meant to be the emotional highs in your gaming experience, there is no excuse. Designers need to do a better job of identifying these boss fights, understanding their importance to the game's flow, and respecting their role inside the game experience. They need to build them early, playtest them often, and react in ways that result in bosses being interesting, challenging, worthy opponents for the player.

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BIG TUNES, SMALL SCALE

GETTING THE MOST OUT OF SMARTPHONE AND WEB LIMITATIONS USING FREQUENCY

CD QUALITY AUDIO IS THE STANDARD for reproduction quality in digital devices all around the world. Sound Blaster 16 add-on cards from the early 1990s, DAT field recorders, and modern portable gaming systems all like to lay claim to the ability to create or reproduce CD quality audio, or 16 bit 44 kHz stereo sound. Since our iPhones, Androids, and DS systems are capable of playing CD quality audio, that's exactly what we should be delivering to the player ... right?

Much of the music that people remember streaming from their original PlayStation systems was very far from 16 bit 44 kHz stereo. The de facto standard for music playback back then was a paltry ADPCM compressed 4 bit 22 kHz stereo stream. This resulted in a 176 kilobit-per-second data rate, with an audio quality far below average modern MP3s. The crude ADPCM compression could be played with barely any CPU power, but careful listening showed that high volume, high frequency content sounded less like music and more like a strangely concordant hive of bees. The reduction from 44 kHz to 22 kHz takes a huge swath of audio data above 10k and simply discards it.

Despite the huge reduction in quality, people look back on this era of video games as providing some of the best aural experiences in gaming.

These days, our smartphones and handheld gaming systems provide orders of magnitude of more power than the original Sony PlayStation. Still, there are similar limitations from a system and infrastructure perspective that keep our audio assets from reaching CD quality.

CHAINED MELODY

>> *Speaker size limit.* In previous years, we pushed below-CD quality audio through decent size CRT TV drivers. Now, we've got high-quality audio going through handheld device speakers measured in millimeters, rather than inches. Instead of losing huge swaths of high frequency spectrum, the final link of the audio chain truncates the low-end energy. Once the sound hits air, you're not hearing any audio below ~250 Hz. Additionally, these smaller speakers aren't equipped to handle much energy. Louder volume sounds and multiple sounds playing simultaneously don't like being played through smaller speakers; they prefer to distort rather than reproduce cleanly.

Application size limit. While older consoles were limited by RAM, smartphones are limited by the application size. For years, both developers and users of iPhones on AT&T have been painfully aware of the 10 MB limit on application download size over cellular. The new kid on the block, Android, doesn't have this particular problem, but does force app downloads to squeeze into mere dozens of free megabytes of internal phone storage space, even if a multi-gigabyte SD card is installed. It won't be until the widespread release of Android 2.2 that apps can install to external storage cards, and millions of older devices will never see that update.

Designing audio in the face of these significant limitations means that on top of thinking about sounding "cool" or "full" or "awesome," we need to remain focused on one of the most basic building blocks of good game design: intelligible communication. Does the sound actually function the way it was intended? Does crucial information get conveyed? Does it get mauled into something completely contrary to the intention?

Listening to the audio on the target device is really important, though it's rarely the first thing I try while monitoring work intended for handheld devices. Instead, I've relied for many years on an old tool called the Nokia Audio Suite, which is a free download from Nokia's website for registered developers. Besides offering tools for creating SP-MIDI content (remember that?), the package includes a VST plugin that portrays how audio would sound through any of dozens of six-year-old cell phones. While the Nokia 3220 and N-Gage have long since lost relevance, the many varieties of small speakers and plastic shells give us plenty of insight into what our audio could sound like to the smartphone users of the world.

If your audio sounds good on your studio monitors both with and without the Nokia auralizer plugin, you're probably good to go. If it sounds like mud, though, it might be time to go in with a scalpel and start peeling away what you don't need. Maybe the sound playback is balking at your low-frequency energy. Try a band cut filter centered around ~250 Hz with a moderate Q (width) and start turning it down. That point between what the speaker is actually capable of playing and what it isn't often contributes to the muddy sound. If that doesn't help, try simply rolling off the sound below 250~300 Hz, first gently, then more aggressively if need be. Both options can clean up a "good" sound that seems murky on a handheld device, but the first option allows you to retain low-end energy that will be of benefit to headphone users.

IT'S THE FREQUENCY, KENNETH!

>> In some cases, it's not simply a matter of taking out the low-end content that can't be properly reproduced. Sometimes you just need to reduce the total energy present in an audio or music file. Besides redesigning the sound as simpler to begin with, judicious use of EQ to remove extraneous energy in the asset can help greatly. Traditional EQ tools can do the trick, but sometimes I like to load up a bit of software for this specific task: Adobe Soundbooth. Soundbooth provides a fantastic look at the audio as an editable image of frequency content over time. With this different perspective, I can easily mask different bits or swaths of sound energy using tools similar to Photoshop. For both general noise reduction and more fine-grained audio cleanup, I've found Soundbooth to be an excellent addition to my existing workflow.

If you've gone through this audio cleanup process with all of your music and sound effects, you'll find that you've taken care of not only the speaker size limitations, but also the memory size limitation. Those mysterious black boxes—MP3 audio compressors, OGG compressors, and the like—use clandestine schemes to work their aural magic. Changing the target bitrate numbers will change your quality and file size, but if you really want your compressor to work better for you, you should feed the compressor better quality material. Having less extraneous sound energy for the compression algorithms to deal with means more bits devoted to meaningful audio content, which means a potentially even better ratio of quality to size.

Nothing like killing two birds with one stone!

VINCENT DIAMANTE *is a music composer and educator in the Los Angeles area. He penned the score for ThatGameCompany's* FLOWER *and currently teaches at USC. Email him at* ***diamante@gmail.com****.*

GDC EUROPE CONCLUDES, GDC ONLINE ANNOUNCES AWARD FINALISTS

LEAGUE OF LEGENDS LEADS FINALISTS FOR THE FIRST ANNUAL GAME DEVELOPERS CHOICE ONLINE AWARDS

/// Organizers of the Game Developers Conference Online (formerly GDC Austin) have announced the nominees for this October's first annual Game Developers Choice Online Awards, revealing that Riot Games' League of Legends is leading the pack, having been nominated for a total of five awards.

Other titles being honored with multiple nominations include We Rule (ngmoco), Champions Online (Cryptic), Dungeon Fighter Online (Nexon), and Nightclub City (Booyah) with three award nominations apiece.

The all-star list of nominees also includes nominations in new game and in-operation game categories for top companies like Blizzard (for World of Warcraft), Playfish (for FIFA Superstars), and Zynga (for FarmVille and Treasure Isle).

The Game Developers Choice Online Awards will be held on the evening of October 7, 2010 as part of the 2010 Game Developers Conference Online (GDC Online), which is taking place at the Austin Convention Center in Austin, Texas October 5–8.

The Game Developers Choice Online Awards—a sister event to the Game Developers Choice Awards which takes place at GDC in San Francisco every year—is the first award ceremony honoring the accomplishments of the creators and operators of online games.

This includes categories around community support and continued innovation in the field with awards in audio, design, and visual arts, among other categories. These categories are nominated and voted on by the game development community, with the distinguished GDC Online Advisory Board helping to pick the special awards.

The nominees of the Game Developers Choice Online Awards run the gamut of online titles, from expansive MMOs through addictive social network-based titles, from Blizzard's World of Warcraft to Zyngna's FarmVille. The most honored nominee is Riot Games' critically acclaimed League of Legends, a multiplayer online arena game that combines role-playing, strategy, and action to create a captivating online experience.

Here is the complete list of nominees for the 2010 Game Developers Choice Online Awards:

Best Online Game Design (new)
- We Rule (Newtoy/ngmoco)
- Champions Online (Cryptic)
- Zoo Kingdom (Blue Fang)
- Dungeon Fighter Online (Neople/Nexon)
- League Of Legends (Riot Games)

Best Online Visual Arts (new)
- GodFinger (Wonderland/Ngmoco)
- Papermint (Avaloop)
- League Of Legends (Riot Games)
- Star Trek Online (Cryptic)
- Love (Quel Solaar)

Best Online Audio (new)
- Nightclub City (Booyah)
- Champions Online (Cryptic)
- We Rule (Newtoy/ngmoco)
- Music Pets (Conduit Labs)
- Aion (NCSoft)

Best Online Technical (new)
- Global Agenda (Hi-Rez)
- Aion (NCSoft)
- Love (Quel Solaar)
- League Of Legends (Riot Games)
- Champions Online (Cryptic)

Best Social Network Game (new)
- Nightclub City (Booyah)
- NanoStar Siege (Digital Chocolate)
- FIFA Superstars (Playfish)
- Social City (Playdom)
- Treasure Isle (Zynga)

Community Relations (ongoing)
- Wizard101 (KingsIsle Entertainment)
- Free Realms (Sony Online Entertainment)
- EVE Online (CCP)
- Guild Wars (ArenaNet)
- World of Warcraft (Blizzard)

Best New Online Game (new)
- League Of Legends (Riot Games)
- Dungeon Fighter Online (Neople/Nexon)
- We Rule (Newtoy/ngmoco)
- FIFA Superstars (Playfish)
- Nightclub City (Booyah)

Best Live Game (ongoing)
- EVE Online (CCP)
- World of Warcraft (Blizzard)
- Dungeon Fighter Online (Neople/Nexon)
- FarmVille (Zynga)
- League Of Legends (Riot Games)

(Awards marked "new" were eligible to games launching in North America in Open Beta or full version in the 12 months to May 2010, whereas the "ongoing" awards are open to any game currently operating in the market. One additional category has yet to be decided: the Audience Award, which opened in September and currently has the worldwide online game community voting on its favorite game.)

The Game Developers Choice Online Awards will also be honoring landmark titles and deeply influential figures in the vibrant online gaming world with the Online Game Legend Award and the Hall of Fame award. This year, organizers will be presenting the Online Game Legend award to Dr. Richard Bartle, co-creator of the original MUD (Multi-User Dungeon), the seminal virtual world credited with pioneering online games over 30 years ago.

In addition, the Choice Online Awards organizers have also announced that Electronic Arts' Ultima Online—the Origin-created game that is now the longest continually running massively multiplayer online game in history—will be honored with the first ever Hall of Fame award for online games at the ceremony. Both Bartle and key Ultima Online creators will be present for the ceremony, and will also be giving lectures at GDC Online itself on their work.

GDC EUROPE 2010 ENDS WITH RECORD ATTENDANCE, CONFIRMS 2011 RETURN

/// The Game Developers Conference Europe 2010 has concluded a second successful year, confirming record overall attendance across paid attendees, media, speakers, and exhibitors to the August 16–18 show.

At the same time, organizers have revealed a return to Cologne, Germany for a third GDC Europe show—again opposite GamesCom—on August 15–17, 2011.

Produced by UBM TechWeb Game Network, organizers of the leading worldwide Game Developers Conference series, GDC Europe is the largest professionals-only game event in Europe, presenting the latest trends and technology in all aspects of the gaming space for developers, consumers, publishers, and trade professionals.


Cologne, Germany.

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GOOD JOB!

new studios

Former employees of Atari, EA, and Vodafone have opened UK-based studio Gamer-Party Limited, a casual games studio that recently launched its own free-to-play portal.

Casual gaming company Miniclip has announced its new mobile division that will focus on bringing the studio's titles to iPhone and Android platforms.

Paulina Bozek, former head of Atari's London-based online and casual gaming studio, has launched Inensu, a start-up company focusing on social games.

who went where

FARMVILLE developer Zygna announced that it has appointed Owen Van Natta, formerly of MySpace and Facebook, as its new vice president of business operations.

Social and casual gaming startup Zattikka has hired Codemasters and Lionhead veteran Peter Jones as an executive producer, and former Sega Europe producer Jim McDonagh as an external producer for the company.

Meteor Games, known for social titles ISLAND PARADISE and RANCH TOWN, has appointed advertising veteran Zac Brandenberg as its new CEO, in hopes of improving the company's monetization strategies.

KATAMARI DAMACY and NOBY NOBY BOY creator Keita Takahashi has left Namco Bandai, and has expressed interest in pursuing work outside of the game industry.

Ubisoft veterans Martin Carrier and Reid Schneider have joined Warner Brothers as studio head of Warner Brothers Montreal, and executive producer, respectively.

Xbox co-creator Kevin Bachus has joined former AOL-owned social networking site Bebo as chief product officer for the service.

BRATHWAITE GOES SOCIAL

TRAIN DEVELOPER JOINS LOLAPPS

Brenda Brathwaite is perhaps best known for her work on the Wizardry series of games, but more recently has been making moves in the social game space. Previously a consultant with Slide, Inc, she's now creative director of Lolapps (Garden Life, Band of Heroes), as well as an advisor to Game Developer *magazine. We spoke with Brathwaite about her new position, and what the social game space means to her.*

***Game Developer:* What have been the biggest challenges in moving into the dedicated social game space?**

Brenda Brathwaite: Funny how I read that word "challenges." Moving into the social space has been one of the most wonderful, fun, intellectually stimulating and satisfying experiences of my career. Games, in general, are full of challenges, and as players, we enjoy them and respond to them positively. That's how this transition has felt to me. There is a lot to learn, and I've loved every step of the path. This field is incredibly dynamic, and the small teams, fast iteration, and contact with the community make it very rewarding for me.

If by challenges you mean "difficult things," there is a melding that will eventually happen between the AAA space and the social space ... the comments that these aren't real games and the like. That will pass eventually. We've gone through many iterations in our past. I remember when games with cutscenes were slammed for not being "real games" and when computer games were slammed because you weren't playing with a "real person" in a "real game."

***GD:* In your role as creative director, you advocate opportunities for closure in social games. How do you ensure that?**

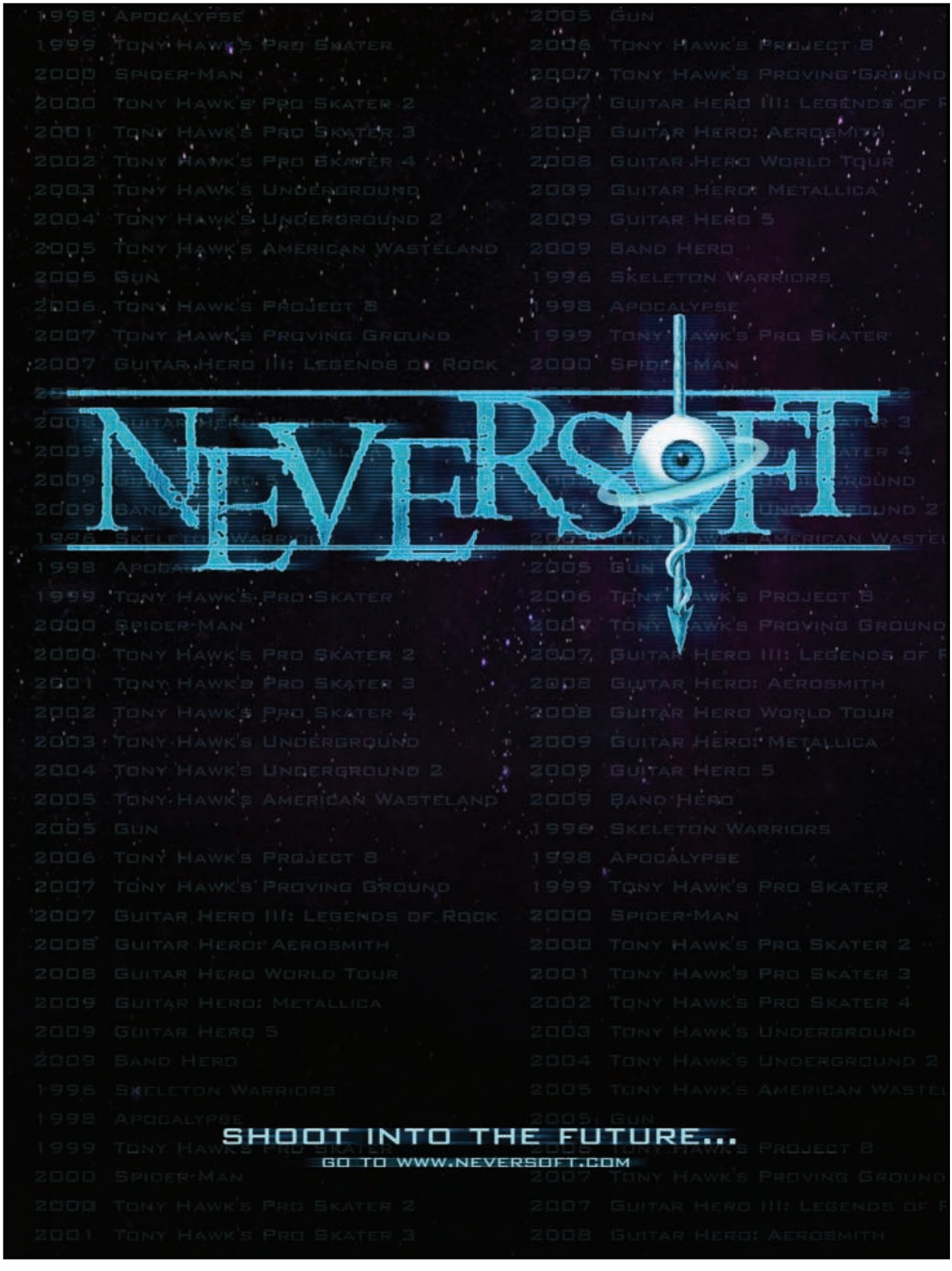
BB: I make games that I want to play, same as I have always tried to do. People who play Facebook games are coming to your game with a specific task list that they want to close out at the end of play. Arrive, tend, optimize, get out. So, I think about the different types of players, the different play styles, and I make sure that they have those moments when they feel good walking away from the game. I can't feel like my absence is going to affect the game negatively or make me lose a significant opportunity. I need to feel good leaving and know precisely when to come back and why I want to. There's more to it than that, but having closure is critical for players of social games.

***GD:* There has been a lot of hiring in the social games space in the last few years—do you see this as sustainable, in terms of employee retention and future hiring?**

BB: Oh, I don't know. I see the game industry as a whole as sustainable. Five years ago, Facebook wasn't considered a "platform" by the industry, so it is hard to say where we're going from here. What is important to me is that I adapt, that I stay current, that I continue to evolve platform to platform, whatever that platform may be.

***GD:* How do you view monetization in these titles? There are varying theories about how deeply entrenched in your game design it should be.**

BB: It depends on the game and the core demographic for it. Some games rely on decoration for their monetization while others rely on the energy model, for instance. I believe that monetization should be in the direct path of the core gameplay if it is to have a solid chance. What is the core mechanic? How can you make it bigger, better, faster, more? Those are your opportunities.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2005 Gun
2006 Tony Hawk's Project 8
2007 Tony Hawk's Proving Ground
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NATURE VERSUS TECHNOLOGY

FIG IS A COLORFUL 3D ACTION GAME DEVELOPED BY THE BROKEN MIND GAMES TEAM AT THE ART INSTITUTE OF LAS VEGAS. CREATING THE GAME WAS A NEW EXPERIENCE FOR THE TEAM AS THEY MOVED FROM WORKING WITH THE UNREAL TOURNAMENT 3 EDITOR TO UNITY. HERE, CREATIVE DIRECTOR BRENDON FITZGERALD AND LEAD LEVEL DESIGNER MIKE SCALA FROM BROKEN MIND GAMES SPEAK WITH US ABOUT THE CHALLENGES AND POSSIBILITIES BROUGHT ABOUT BY THE SWITCH.

Jeffrey Fleming: ***How well did the Unity engine work for the team?***
Broken Mind Games: Using Unity was a dream come true. At the beginning of the project, a few of us were totally against using Unity simply because we had been using the UT3 Editor for almost two years. We had grown to know it very well and were very comfortable with it. The rest of the team, which made up the majority, had all been using Unity for six months, so they had some experience with it.

JF: ***What was Unity's learning curve like?***
BMG: The learning curve for Unity was really fast due to the fact that the interface is so user friendly and primarily drag-and-drop. The Unity forums are also extremely informative; there's a really good community there. Unfortunately, the shortcomings of Unity are not very well documented. We had to discover the limitations for our levels the hard way. Lighting and animation are the killers.

JF: ***Did the ability to tweak in Unity's editor while the game is running affect your level design process?***
BMG: It did, but for the better. Comparing Unity's editor to Unreal's is like night and day. Every time an object is added into Unreal, you have to build the level to see what happened, which is a pain. Being able to edit the level while it is running didn't necessarily change the level design process so much as it changed how quickly we could playtest. Any changes you make while the game is running revert to what they were before you ran it. It really is just a convenient way to experiment with some of your settings and see their results in real time. It was really useful to not have to wait for the playtesting results to find out if something is working, but of course playtesting was still necessary to create a functional game that was fun.

JF: ***How did you organize playtesting?***
BMG: Before any outside playtesting began, our team was given a weekly task to play through the entire game and document as many notes as they could. As testing continued, we found that certain people on the team were better suited to looking at a particular part of the game. We actually had one member of the team dedicate his playtesting to just finding out ways to break the game.

Once we were close enough to alpha, we had peers and instructors playtest and document their feedback. Lastly, around an unofficial "beta" period we opened up testing to friends and other students outside our major.

JF: ***How long did it take to develop FIG?***
BMG: FIG was in full production for a year, from July 2009 to June 2010. However, Brendon worked on the game design document months beforehand to prepare the team for a running start. Additionally, a small portion of the team plans to continue polishing the game further.

JF: ***What did you work out on paper ahead of time?***
BMG: The design document was pretty fleshed out before the team was assembled in regard to the story, characters, and mechanics (including camera, enemies, and interface). Then once the team was fully gathered and on board, we spent an entire quarter putting everything else down on paper before any assets were created. We completely penned out the level layouts, collectibles and enemy placements, puzzles, and concept art, in addition to embellishing and refining the story and interface.

JF: ***How did classes at the Art Institute prepare you to create FIG?***
BMG: Like any school offering a degree in game design, the required courses were offered: level design, scripting, game prototyping, and 3D modeling classes. Of course, what good is a game without an engine to work off? Throughout most of our time at school, the UT3 Editor was the tool of choice. Fortunately, our school listened to our demands and got us the Unity Engine. This not only allowed us to do things with FIG that we couldn't do with UT, it more importantly let us experiment with using an actual "engine" rather than just an editor.

JF: ***What were the biggest challenges in developing FIG?***
BMG: One of the biggest challenges for us, as it probably is for any student project, was team chemistry. We worked really hard at getting the group together into a unified and motivated

team. We went through a couple team names, numerous heated arguments, and the loss of multiple team members.

Some of us had several classes together. Unfortunately, we never realized how special of an opportunity that was, and as a result, we didn't utilize this until late in the development cycle. Communication in each department wasn't bad, but when it came time for the level design team to talk with the animators, it just didn't happen as much as it should have. If the communication from department to department were better, we would have definitely had a much smoother ride. In the end, we created a passionate and somewhat single-minded team of people who all wanted to just make this a fun and unique game.

—Jeffrey Fleming

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STACK TRACE *RETURNS*

THE CASE OF THE WHITEBOARD DEFILER

A VOICE ROUSED ME FROM A DEEP sleep in my office chair, at half past the witching hour. It was Lexer McNally, his voice crackling with a mix of fear and AT&T 3G coverage. "Stack, I need you to come in right away," he panted. "Something's happened, something big. They might be after me!"

I didn't bother to ask who because it was obvious he didn't know. That's why he had called me, Stack Trace—the best P. I. in this two-bit town they call game development. I told him my usual rates applied—plus expenses—and he agreed right away. Lexer agreeing off the bat to pay someone ... whatever had happened, it must have scared him good. Either that or he was planning to take me for a ride. But nobody rides the Trace train but Trace.

When I got to his office the dame behind the front desk was still there; Lexer must have asked her to stay late. She had purple streaks in her hair and enough piercings to set off a metal detector inside a level of BULLETSTORM. "Mr. McNally is waiting for you inside," she said, eyeing me skeptically.

I ducked past the homemade 'Crime Scene—Do Not Enter' tape and entered the conference room. Two building security guards, an HR rep, and Lexer were nervously milling around in front of a STREET FIGHTER IV beach towel that had been hung up to cover a whiteboard.

"Stack," Lexer said, rushing over. "Stack, thank God you're here. I can't believe what's happened."

"Calm down. Let's take a look."

He hesitated. "I'm warning you. It's bad."

"Don't worry. I've seen a lot of game studio whiteboards over the years. A whole lot."

Lexer sucked in some air through his teeth and pulled the towel back. Me and my big mouth. You think you've seen it all, and then something comes along that does a hard reset on all your expectations. This image sent shivers up my spine.

"Hmm," I said, forcing myself not to look away. "Well, I can say one thing. That part of it really looks like you, Lex."

"Enough with the wisecracks. This drawing ... it mocks me. My head, it's coming out of a ... it's ..."

"I can see that, Lex. Whoever it was has a really good knowledge of anatomy, too. Look at all that detail there. And there. Uncanny, really."

"Listen, Stack, we need to nab the offender right away. I don't want someone running around the studio drawing stuff like this. Especially not now. It's a sensitive time."

"Why, what's going on?" I asked, reaching into my specially oversized coat pocket for my iPad.

"Well, we're in the middle of restructuring our business, to better align our development capability with changing market conditions ... "

"You mean you're laying people off?"

"Don't say it that way, Stack. The employees might hear you. They don't know that's what it means!"

I carefully combed over the scene of the crime looking for clues. The drawing was done in dark blue dry-erase marker, but I didn't see any of those in the tray—just red, brown, green, and yellow. Who even uses the yellow ones, anyway? The miscreant had been smart enough to dispose of the evidence. This was no run-of-the-mill vandal.

"Lex, I need to interview everyone on your team individually. One on one. I'll start with the artists."

"It wasn't an artist. I know that much," he said, looking at the walls nervously. "See, we, uh ... we got rid of them a couple months back. Outsourced everything to China. Unless someone came here on a plane from Suzhou, it wasn't one of them."

"You what?"

"Look ... times have changed, Stack. You think I can keep funding my lifestyle on the kinds of margins we're seeing these days?"

I noticed a small rubber ring on the floor beside the whiteboard. A piece of a pen, maybe? Suddenly, I remembered something I saw earlier that evening, and a flash of inspiration hit me.

"Lex, I've got a hunch who the perp is. You stay here. I'm going to go confront her."

ILLUSTRATION BY JUAN RAMIREZ

"'Her?'" Lexer's eyebrows shot higher than the premature valuation of a Facebook game company. "There's only one female who works here! You couldn't possibly mean ..."

I rushed back out into the lobby. The front desk girl was browsing images on deviantART that were definitely not safe for work.

"So, how does it feel to use your artistic abilities for evil?" I asked her.

"It feels pretty good, actually," she said. "How did you figure out it was me?"

"For starters," I said, "Lexer said he got rid of all the artists, but you looked like one of those art types from the moment I met you. Second, I found this rubber ring at the scene of the crime. This is for those four-gauge plugs of yours, isn't it? Finally, there's the dark blue dry-erase marker on your desk there."

"Guess you got me, detective," she shrugged.

"There's still one thing I don't understand, though. Why did you do it?"

"Because Lexer is a self-important dumbass with terrible ideas who mismanaged his studio into laying off a bunch of talented people."

"Well now. I guess that's a good reason."

"Can I have my o-ring back?"

"Sure. Listen, sweet cheeks, you shouldn't be behind the front desk with the skills you have. You could be working in the big time. Let's say on the DANTE'S INFERNO monster design team or something."

"If you want a real case, maybe you could look into why I don't care about that," she said.

I was stumped, but the case was closed. I stepped back outside into the driving rain that seems to follow me like a lost puppy. Her words echoed through my head. Why didn't she care? I decided that would be the target of my next investigation, even if I had to foot the bill myself.

MATTHEW WASTELAND *writes about games and game development at his blog, Magical Wasteland (www.magicalwasteland.com).*

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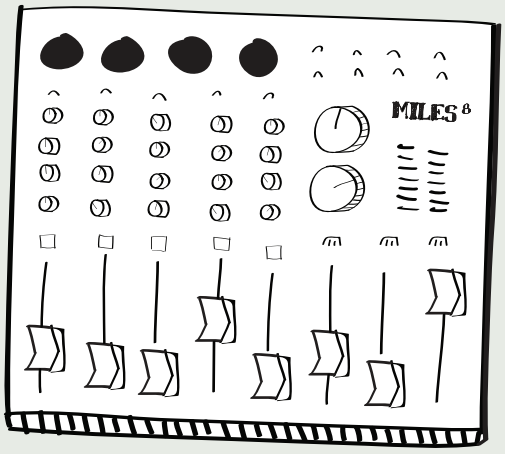

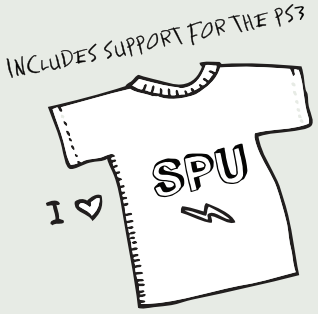

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