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APRIL 2005

game developer

THE LEADING GAME INDUSTRY MAGAZINE

>> 2005 SALARY SURVEY
INDUSTRY FIGURES,
RELEVANT NUMBERS

>> KNOW YOUR COMPETITION
CAN EVERYONE LEARN
FROM THE MMORPG?

>> EA TALKS PSP
LAUNCH TITLES &
TECHNICAL DETAILS

POSTMORTEM:
JEDI MIND TRICKS
CHOICE AND CONSEQUENCE IN
STAR WARS: KOTOR II

Let's shed some light on mobile Java 3D development.

```
private Vector3D dir = new Vector3D(-3511, 731, 878); // Light
vector
private final int dirIntensity = 4096; // Light intensity
private final int ambIntensity = 1755; // Ambient light intensity

...

light = new Light(dir,dirIntensity,ambIntensity);
effect = new Effect3D( light, Effect3D.NORMAL_
SHADING, true, null);
...
g3.renderFigure(figure, 0, 0, layout, effect);
```

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gamedeveloper

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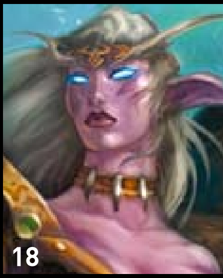
You can't climb the ladder if you don't know what's up there. Career-minded people must be able to formulate reasonable expectations in their fields in order to negotiate their salaries and know, at least generally, where their future might take them. For the fourth year running, *Game Developer* is proud to serve the developer community by amalgamating statistics into an overview outlining the pay structure of today's video game industry.

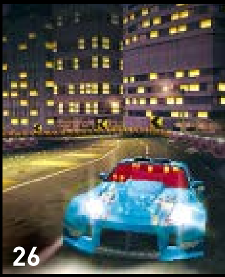
By Jill Duffy



18 EVERYTHING YOU NEED TO MMO

The MMO seems to be a much misunderstood beast. Although currently PC-centric and grounded in the fantasy genre, more conventional game creators also have a lot to learn from the price, subscription, and digital download tactics of the massively multiplayer online game, buried in a niche but surprisingly ahead of the field.

By Evan Shamoon



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The PSP is still somewhat mysterious to many developers, even larger ones such as EA's Team Fusion, tasked with delivering six North American launch titles. Dave McCarthy, a producer within the team, talks about surmounting these development hurdles for the first generation of PSP games.

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Obsidian Entertainment, which commandeered the second Knights Of The Old Republic title, rooted the game's storyline in the effects of player choice. Using an "influence system," auto-balancing, and other elements, the developers battled harsh deadlines to extend the first game into a new iteration, rather than merely regurgitating the original.

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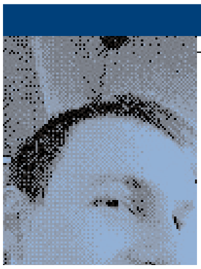

MONEY HATS

WELCOME TO *GAME DEVELOPER*'S 2005 SALARY Survey issue! Although traditionally conducted a little earlier in the year, we've moved the salary survey back a couple of months, tucking it just after the Game Developers Conference in order to have proper context, quiz a total of 2,091 professionals, and more fully present the latest research into exactly who is being paid what and by whom, in the video game industry.

We were recently contacted by a developer eagerly awaiting this year's installment, as he and his co-workers helped justify possible pay raise requests by referencing each year's results, neatly underscoring the importance of the Salary Survey. Although we can't promise that waving the magazine furiously in your management's face will adjust your wages accordingly, the results are comprehensively researched enough to present a fair look at where developer concentration and remuneration are headed.

FETT'S VETTE

Elsewhere in the magazine, this month's post-mortem is from Obsidian Entertainment, the Black Isle alumni whose first completed project was Star Wars: Knights Of The Old Republic II—The Sith Lords, the sequel to BioWare's critically and commercially adored Xbox and PC RPG (also at one time a *Game Developer* cover story). How do you take an engine from another team and produce a sequel to a much-loved game, in a relatively short time span but still play intelligently on the strengths of the first title? Senior designer Kevin Saunders takes us through the ups and downs of doing just that, with a special emphasis on how the sequel's moral choices were enhanced and story entwined intelligently within them.

MMO IT ALL?

Ever felt just a little ... different? Did your parents give you pocket money every day, not every week, and let you play in places that the other kids couldn't? If so, you probably can empathize with massively multiplayer games, which, as a genre, stand apart from all other games for a multitude of reasons. MMOs are catching the eye of more serious investors, and standing defiantly apart from the relatively sagging PC game market. Most of all, they're helping to pioneer the mass digital download of paid content through recurring subscription fees and constant improvements. But what can more traditional titles learn from MMOs and vice versa? Evan Shamoon examines the coming convergence in "Everything You Need to MMO," (page 18) discussing whether non-MMO games will start to charge for directly downloadable content and dogs and cats will inevitably start living together.

In addition to all of the above goodness, the rest of the issue packs some punch too, including a very candid interview with Electronic Arts' Dave McCarthy, discussing the technical challenges of creating EA's PSP launch titles (page 26). A special business column by Dan Lee Rogers (page 44) focuses on a contract clause that developers would do well to heed when signing publishing deals. Our back page highlights the true stars of Namco's Tekken 5, and a special guest audio column lets Ritual's Zak Belica air his thoughts on how to be a voice director.

GDC REFLECTIONS

This editorial was actually written just a couple of days after GDC—although, due to the shortage of wood ants to chew up great tracts of Canada and excrete your copies of the magazine, you may not see it for a few weeks further. Nonetheless, this year's show was a rollicking romp of an event, thanks to some great lectures and roundtables, worthy award-winners, a packed expo show floor, and Microsoft's and Nintendo's keynotes, which were both provoking in contrasting ways.

Regarding those keynotes—some news outlets have been rather scathing regarding what wasn't discussed or unveiled, especially in J Allard's "HD Era" speech. But, taken as a statement of intent, Microsoft's plans are still formidable. As for Nintendo, well, cute digital puppies and surreal plankton-based remix utilities are business as usual for the firm that continues to plow its own furrow; and Satoru Iwata's impassioned history of his development days was a welcome treat to many.

For the *Game Developer* staff, however, the highlight of the show was probably the appearance of both regular and albino gorilla suits, making GDC 2005 a rare two-gorilla year. And, if you see lots of gray baby gorillas at GDC 2006 back in San Jose, then you'll know that the show was more pro-creational than the organizers ever imagined.

S!

Simon Carless, Editor

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HEADS UP DISPLAY

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MICROSOFT ANNOUNCES XNA STUDIO AT GDC '05

Microsoft's J Allard waxes lyrical at his GDC keynote.

AT GAME DEVELOPERS CONFERENCE 2005, Microsoft more fully fleshed out its XNA concept, with the help of J Allard's XNA-referencing keynote, announcing a major new product named XNA Studio. Based on the Microsoft Visual Studio 2005 Team System, XNA Studio is an integrated, team-based development environment tailored specifically for game development that will likely launch as a retail product early in 2006.

In particular, XNA Studio builds on top of Visual Studio, currently the tool of choice for many game programmers, and adds asset management, defect tracking, and project automation tools, as well as significant workflow functionality. This new build framework and integrated tool suite is intended to make XNA Studio important to artists, designers, QA testers, and even producers.

Chris Satchell, the general manager of XNA at Microsoft, says XNA Studio can definitely be described as Visual Studio for game development, but that it's targeted at the whole development team, not just programmers. Microsoft and the XNA team have apparently been talking to people in the industry about the problems they will face going into the next generation of consoles. "Consumers are demanding richer experiences. There's both a complexity problem and a volume problem [for assets]," says Satchell.

Thus, the XNA team has been addressing what it considers to be the major problem—how can game developers be enabled to get their content through to their game in an efficient manner when game teams are getting so large and data so complex? The answer, according to Microsoft, is to use only one tool to handle the code, art assets, physics data, collision data, and sundry other chunks of information which make up a game. XNA Studio is intended to create a robust, scalable, repeatable build process alongside a unified file format, currently called XIF, which drives that build process.

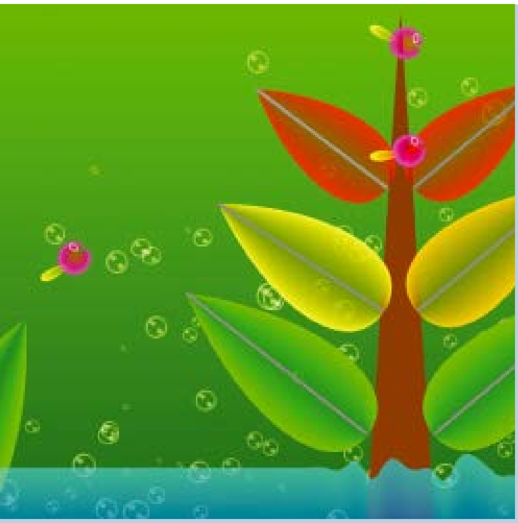
The game assets are then packaged in an asset management system, which also includes bug tracking and workflow tools, all built around Visual Studio as the core tool for programming and compiling. But Satchell explains that the team is "making sure we do the work to make [XNA Studio] specific to the games industry." The close relationships between code, art, audio, QA, and production are intended to be very directly addressed in the tool.

For example, it was suggested that art assets could be checked into the asset management system, and then a producer could use workflow tools to view and sign off on specific major art assets within the XNA Studio interface. The producer could also create an exportable document which lists assets that had been approved. It's also intended that artists should be able to compare several versions of previously checked-in textures, whose vertices have changed. With the same package, a programmer would be able to view a particular software bug, fix the error in code, and have the bug marked as fixed in the bug tracking part of XNA Studio as the code is checked in. Automation workflows for code testing will also be part of the application, and fairly complex plug-ins should be possible, even graphical workflow tools such as polygon reduction pipelines. However, it's important to note that art creation is not part of XNA Studio—just asset control and workflow/export related tasks.

But when will XNA Studio be available? It was indicated that the full version of Visual Studio 2005 Team System will debut in Fall 2005, and that targeted alpha versions of XNA Studio, which is based on the former product, should appear toward the end of 2005. The XNA team is hoping to have a public version of XNA Studio usable by March 2006. By then, it should be much easier to see if Microsoft's grand plans to help manage the ever-expanding game development processes are working out.

— Simon Carless

ELECTROPLANKTON CONFOUNDS, ENCHANTS



Electroplankton, a DS title showing Nintendo's unconventional approach.

ANNOUNCED JUST BEFORE GDC, and also showcased in Satoru Iwata's keynote at the show, Nintendo is producing a new music-related DS title which it describes as an "interactive work of art." The game, Electroplankton, is being made in association with Toshio Iwai, a Japanese sound artist who's best known for creating Sim Tunes for Will Wright's Maxis studio, another interactive title heavily involving music.

Electroplankton makes extensive use of the DS touch screen in order to have the player control small plankton creatures and other graphical widgets, allowing even the non-musical player to create sounds by simply touching the relevant parts of the screen. The game also uses the DS microphone to sample voice and play it back in looped sections using quirky fish-related graphics, allowing simple multi-track recording to take place, and even allows the remixing of classic Nintendo game music including the Super Mario Bros. theme by intuitive use of the touchscreen.

Electroplankton will launch in Japan this month and comes with a free pair of headphones. U.S. and European releases for the quirky title are not yet confirmed, but given Iwata's showcasing of the game, it seems likely to get a Western release later in 2005, alongside Nintendo's other more unique DS titles such as puppy simulator Nintendogs.

— Simon Carless

EA GIVES RENDERWARE TO UNIVERSITIES

ELECTRONIC ARTS, WHICH ACQUIRED CRITERION Software last year, has announced that it will be donating a special academic version of the award-winning RenderWare software development kit to any accredited institution that would like to use it to create graphic and game design curriculum. The company announced that institutions interested in participating need only send a letter describing their intended use to renderwaredeployment@ea.com.

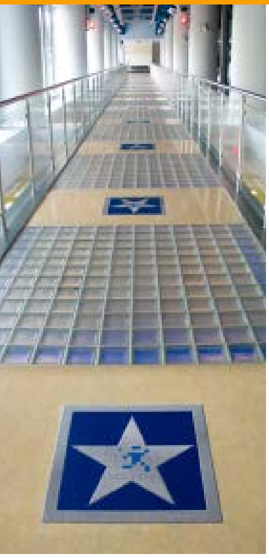
Developed by Criterion, RenderWare is an extensively used middleware solution, with more than 500 games to its credit. RenderWare is a portfolio of game development tools, which include RenderWare Platform and RenderWare Studio for the PlayStation 2, Xbox, Gamecube, PC, and the Nokia N-Gage.

"This gift is a shot in the arm for academic institutions that are looking to accelerate their graphic and game design programs," said Steve Seabolt, vice president of EA. "By providing this tool, students and teachers can get first-hand experience with the game development platform used by the world's top designers and leading game companies. We're sharing one of our most important tools with the hope it will further inspire and better inform students about real world game development."

This gift is the latest in a series of long-term investments EA is making to interactive entertainment education, which includes a robust internship program, an aggressive on-campus lecture series and the creation of the EA Interactive Entertainment Program at the University of Southern California.

—Jill Duffy

Backbone's RenderWare-using PSP title, DEATH JR.



WALK OF GAME INDUCTEES HONORED

THE FIRST EVER INDUCTEES into the "Walk of Game" at the Sony Metreon had their stars unveiled in an event that coincided with 2005's GDC, as Shigeru Miyamoto (creator of MARIO BROS. and THE LEGEND OF ZELDA) and Nolan Bushnell (co-founder of Atari and creator of PONG) became the first recipients of the Lifetime Achievement award.

Four additional stars celebrating favorite games and characters were unveiled: Master Chief (HALO), Link (THE LEGEND OF ZELDA), Mario, and Sonic the Hedgehog.

The event was attended by Nolan Bushnell, Simon Jeffery of Sega of America, Takashi Iizuka from Sega Studio USA, Marty O'Donnell of Bungie Studios, and Bill Trinen of Nintendo of America.

"Video game sales have eclipsed Hollywood box office revenue and it's time that those who aren't aware of this stand up and take notice, or fail to do so at their own peril," said San Francisco Mayor Gavin Newsom, who attended the event. "San Francisco recognizes Walk of Game Day to honor and celebrate the incredible achievements made by video game icons and pioneers, and we are extremely proud to finally have a Walk of our own to honor these accomplishments."

The four game characters and the top two lifetime achievers earned their awards through a vote by game players worldwide and received a customized star installed on the floors of the Metreon, a 350,000 square-foot entertainment center in downtown San Francisco. 2006 nominations for Walk of Game will be announced later this year.

—Staff

AGEIA ANNOUNCES PHYSX PPU, NOVODEX SDK

AGEIA TECHNOLOGIES RECENTLY ANNOUNCED ITS PHYSX HARDWARE chipset, alongside the latest version of its NovodeX Physics SDK, a middleware physics software engine for creating dynamic physical environments on all major game platforms.

The NovodeX Physics SDK is the first asynchronous (multithreaded) physics API capable of unleashing the power of multiprocessor gaming systems. It also is the only SDK to offer comprehensive API support for the first-ever physics processing unit, Ageia's PhysX chip.

The PhysX chip, due to launch as a PC add-on card later this year, is intended to be a stand-alone physics processing unit (PPU) in the same way that the GPU is currently purchased on graphics cards, and Ageia is leveraging its NovodeX Physics SDK to allow game creators to make both software and optional hardware-enhanced levels and games.

By performing advanced physics simulations in real-time, the PPU can respond to gamer actions as well as environments contributing to what Ageia calls "pervasive interactive reality." Physics will offer a host of advanced, hardware-accelerated features, including universal collision detection, rigid body dynamics, soft body dynamics, fluid dynamics, smart particle systems, clothing simulation, soft-body deformation with tearing, and brittle fracturing for destruction of objects in gaming environments.

"The NovodeX Physics SDK has been available for over a year, which has given game developers a head start in implementing game features that will leverage the hardware acceleration of the PhysX chip," said Manju Hegde, CEO and co-founder of Ageia. "Because of this strategy, we expect to see top-tier game titles in the market by Christmas 2005 that can take advantage of hardware acceleration and deliver unprecedented interactive realism."

The game industry has been signing up to use the NovodeX SDK, especially now that price incentives are being offered on the software solution for those who integrate hardware-enhanced physics features into their games, with leading publishers such as Atari, Sega, and Ubisoft offering support. NovodeX also provides plug-in interfaces for major 3D tools vendors, enabling animators to view their work in a familiar environment. Major game developers on board with NovodeX include Epic Games, which recently incorporated NovodeX into its UNREAL Engine 3 middleware.

—Simon Carless

Half-Life 2

2005 GAME DEVELOPERS CHOICE AWARD WINNERS ANNOUNCED

THE INTERNATIONAL GAME Developers Association (IGDA) announced the recipients of the fifth annual Game Developers Choice Awards at a ceremony during the 2005 Game Developers Conference. Major winners included Valve's Half-Life 2 and Namco's Katamari Damacy, and many of the creators were on hand to receive their prizes, voted on by the IGDA membership.

"The Choice Awards are a celebration of all the passion and hard work that goes into creating ground-breaking games," says Jason Della Rocca, executive director, IGDA. "Developers are the talent that drives this industry and they deserve the recognition for having worked on these great games."

—Brandon Sheffield

WINNERS OF THE 5TH ANNUAL GAME DEVELOPERS CHOICE AWARDS

BEST GAME
Half-Life 2 (Valve Software / Vivendi Universal Games)
Ken Birdwell, Gabe Newell, Jay Shelly

AUDIO
Halo 2 (Bungie Software / Microsoft Game Studios)
C Paul Johnson, Marty O'Donnell, Jay Weinland

CHARACTER DESIGN
Half-Life 2 (Valve Software / Vivendi Universal Games)
Ted Backman, Dhabih Eng, Bill Fletcher, Bill Van Buren

INNOVATION
Donkey Konga (Namco / Nintendo)
Hiroshi Igarashi, Hiroyuki Onoda

I Love Bees (4orty2wo Entertainment / Microsoft Game Studios)
Elan Lee

Katamari Damacy (Namco)
Keita Takahashi

GAME DESIGN
Katamari Damacy (Namco)
Keita Takahashi

TECHNOLOGY
Half-Life 2 (Valve Software / Vivendi Universal Games)
Yahn Bernier, Brian Jacobson

VISUAL ARTS
World of Warcraft (Blizzard Entertainment)
Sam Didier, William Petras, Justin Thavirat

WRITING
Half-Life 2 (Valve Software / Vivendi Universal Games)
Marc Laidlaw

NEW STUDIO
Crytek (Far Cry)
Avni Yerli, Cevat Yerli, Faruk Yerli

WINNERS FOR IGDA'S SPECIAL AWARDS

LIFETIME ACHIEVEMENT
Eugene Jarvis — legendary arcade game developer

FIRST PENGUIN
Richard Allan Bartle, Ph.D — founding father of Multi-User Dungeons (MUDs)

MAVERICK
Matt Adams, Ju Row Farr and *Nick Tandavanitj* — founders and leaders of Blast Theory, an internationally renowned interactive media artists' group

COMMUNITY CONTRIBUTION
Sheri Graner Ray — revered advocate of women's interests in game development

GISH, WIK TRIUMPH AT IGF

GISH AND WIK AND THE FABLE OF Souls have been selected as the top titles of the Independent Games Festival as part of the seventh annual IGF awards. Gish and Wik won top prizes in the open and web downloadable categories, respectively, at a ceremony at the Game Developers Conference.

Game creators from Chronic Logic for Gish and Reflexive Entertainment for Wik were on hand to each receive a $15,000 Seumas McNally Grand Prize, while the other indie game development teams competed for a total of $40,000 in cash prizes.

Wik and the Fable of Souls

THE IGF RECOGNIZED THE FOLLOWING AWARDS IN EACH CATEGORY:

Seamus McNally Award:
- Gish by Chronic Logic (Open)
- Wik and the Fable of Souls by Reflexive Entertainment (Web/Downloadable)

Innovation in Game Design:
- Gish by Chronic Logic (Open)
- Wik and the Fable of Souls by Reflexive Entertainment (Web/Downloadable)

Innovation in Audio:
- Steer Madness by Veggie Games (Open)
- Global Defense Network by Evertt.com (Web/Downloadable)

Innovation in Visual Art:
- Alien Hominid by The Behemoth (Open)
- Wik and the Fable of Souls by Reflexive Entertainment (Web/Downloadable)

Technical Excellence:
- Alien Hominid by The Behemoth (Open)
- RocketBowl by Large Animal Games (Web/Downloadable)

Audience Award:
- Alien Hominid by The Behemoth (Open)
- N by Metanet Software Inc. (Web/Downloadable)

Cartoon Network also announced the winner of Project Goldmaster. Argentinian developer Digital Builders has been selected to design a game based on Cartoon Network IP.

—Brandon Sheffield

calendar

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2005 GDC TOOLS ROUNDUP

Tool makers and other product players in the game space save some of their biggest announcements for the annual Game Developers Conference, which took place just last month in San Francisco's Moscone Center West.

In general, GDC is becoming a launch pad for new initiatives, and tool companies are building out their training and support programs to help deal with the complexity of next-gen gaming.

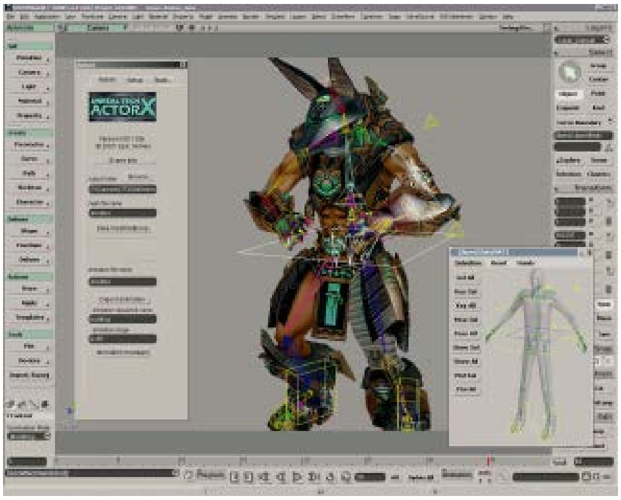
The other major trend proliferating product announcements—which has surfaced not only at GDC but over the past year at large—is a move toward tools that enable a smooth, well-integrated pipeline, tools that facilitate production and, specifically in the art department, free artists from having to rely on programmers for support.

—Jill Duffy

AVID'S COMPETITIVE PRICE POINT, MOD TOOL, AND BODYPAINT

www.avid.com

UnrealActor X Exporter, which Avid announced at GDC, is a collaborative effort from the maker of Softimage XSI (3D art and animation software) and Epic Games, creator of the Unreal engine. The application is designed to create a pipeline for game development using both parties' products. You can also use UnrealActor X in conjunction with Softimage's Mod Tool to affect in-game objects, backgrounds, and other properties.



Avid and Epic Games have teamed up to create Unreal Actor X Exporter.

To strengthen its presence in the game industry, Avid also announced a competitive pricing promotion to new adopters of Softimage and Alienbrain, an asset management program. The trade-in promotion, which ends April 15, targets users of 3D Studio Max and Visual SourceSafe and offers up to a 70 percent discount for a limited number of seats.

Additionally Avid announced the availability of BodyPaint 3D, a plug-in texturing tool for Softimage.

VIRTOOLS' STARTER PROGRAM

www.virtools.com

Virtools, a provider of interactive 3D authoring tools, announced the upcoming introduction of the Game Developer Starter Program at GDC—a program aimed at helping studios multiply their opportunities to sign with a publisher.

The program, which will support small and mid-sized game studios, includes temporary licenses of Virtools Dev, the core component of Virtools' Software Suite. The program is designed to give developers a professional toolset so they may focus on storyline, game design, advanced graphics, visual effects, and gameplay instead of costly programming.

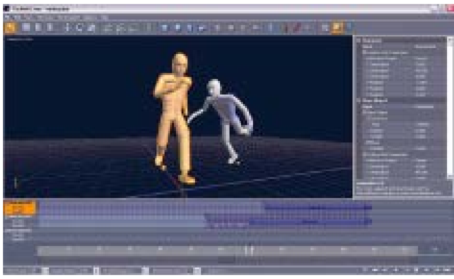
Additionally, Virtools also announced that it will join the roster of supporters for the next generation Xbox platform.

NATURALMOTION'S ENDORPHIN 2.0

www.naturalmotion.com

NaturalMotion launched and began shipping endorphin 2.0, a new version of the animation tool designed to add "adaptive behaviors," or AI-like qualities, to character movements. To conceptualize endorphin, if you missed the demo on the GDC Expo floor, imagine a basic character rig that trips over an object during a walk-cycle; after a few quick clicks and no manual programming, endorphin adds AI-like features to the trip, such flailing arms or the character bracing itself during the fall.

The release also includes support for Alienbrain Studio and Perforce software configuration management systems, as well as an improved GUI.



Endorphin 2.0 from NaturalMotion instantly adds AI features to characters.

ALIAS' FBX AND MOTIONBUILDER PERSONAL LEARNING EDITION

www.alias.com

Alias, the maker of Maya, announced that its development kit for FBX is now available via download for free. The FBX SDK is a 3D authoring and interchange format, that allows you to access 3D objects from various platforms.

The company, which acquired Kaydara and its tool MotionBuilder last year, also announced it will make available a free, non-commercial (close to the Standard edition) version of the tool—MotionBuilder Personal Learning Edition—so that professionals and students alike can learn the software competently prior to purchasing a commercial license.

GENEMATION'S 3D FACE SYNTHESIS TOOLS

www.genemation.com

Genemation, the Manchester, U.K.-based technology start-up, launched two upgraded "face synthesis" tools based on its so-called computer vision technology. Genemation's tools are primarily aimed at supporting digital artists and programmers, and are compatible with industry-standard art/animation packages.

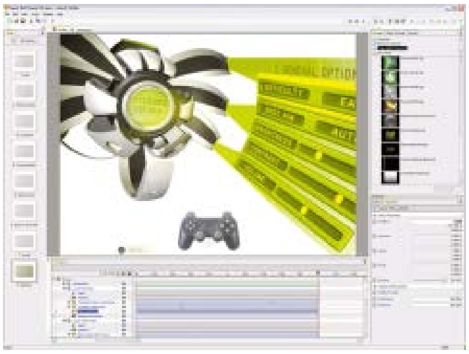
The GenHead 2.0 tool lets users create 3D animated heads from 2D images. Additionally, GenCrowd 1.0 generates thousands of synthetic, copyright free, photo-realistic 3D animated heads by age, gender, and ethnicity. It can generate up to 1,000 individual heads in less than an hour, families and offspring, and specific heads, as well as control and change facial characteristics by individual face or group.

ANARK GAMEFACE FOR GAME UI BUNDLE

www.anark.com

Boulder, Colo.-based Anark announced the availability of its new bundled package comprising Anark Format SDK, which allows programmers to build a user interface pipeline, and Anark Studio, an authoring tool that helps artists prototype and polish the UI.

—Nich Maragos and Jill Duffy



Anark Gameface creates UI for games in both 2D and 3D.

REVIEW: CAMELEON 5000

By Gene Porfido

THE CAMELEON 5000, FROM CAMEL Audio is one of the latest soft synths available for both the Mac and the PC. It can be installed as a standalone tool, VSTi or AU on the Mac as well as VSTi on the PC. The Cameleon is an additive synth that offers quite a few innovative features for musicians and sound designers alike. If you're familiar with Native Instrument's popular Absynth, then you already have a basic idea of the C5000.

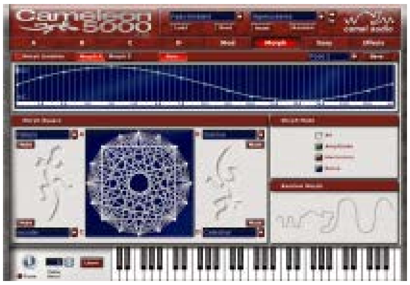
The Cameleon installs effortlessly when you click on and run the installer program. I installed it on a Power Mac G5 with a single 1.8gHz processor and opened the standalone version to check it out. The overall interface is clean and fairly easy to navigate, especially if you're familiar with software of this type. It's worth noting that the design is straightforward and intuitive. You never want the interface to get in the way when trying to explore ideas or create new sounds, especially when under a tight deadline, and the Cameleon's doesn't.

The Cameleon additive synth offers sound designers and composers deep editing and sound shaping possibilities. But less experienced audio folk can explore the Cameleon's basic functions by loading one of 600 presets. Main Preset categories include Organ, Synths, Strings, and Percussion, and more refined sub-categories further classify the presets.

Overall, the sounds in the presets range from delicate and subtle, to incredibly wild and mind-bending. Quality is clean and clear, especially the glassy and metallic sounds. However, I did find the Cameleon a bit light on deep, punchy, bottom end sounds. A few presets are screaming for earth-shaking lows that aren't quite there. Using the M-Bass knob on the Effects page, or working with the Formant Filter can change this, as well as adding external EQ .There are also additional presets available for download online that do offer good bottom end.

The Cameleon's Easy Page is a fast and basic way to edit the program with controls for Timbre (timbre, harmonics, noise), LFO (rate, pitch, amp), as well as Output (output, stereo width, velocity), Voices (polyphony, partials, portamento), Amplitude Envelopes (attack, stretch, release), and the Random Easy. This affords the user quick and effective ways to change the most prevalent parameters without getting into all of the intricate and heavy parameters that deal with visual graphs, timelines, selecting and assigning individual sources and targets (for LFO), and editing individual voice programs. The Easy Page barely touches the surface of what the Cameleon is capable of, minus the learning curve and time it takes to understand how all the available parameters work. However, to really use the program to its fullest and to be able to take a sound, develop an idea and be able to achieve that idea, you need to have complete knowledge of which parameter to change, what it will do and how the outcome will most likely be. Where the Easy Page starts off, the deeper editing pages carry it so much further.

Getting beyond the Easy Page and deeper into the Cameleon is a whole other experience. There is a lot of depth to the Cameleon if you are willing to dig in and learn its nearly limitless capabilities.



Camel Audio's Cameleon 5000 in action.

LIKE A CAMELEON...

Three of the main approaches to creating sounds in the Cameleon are Voice Morphing, Sample Resynthesis, and Sample and BMP/ Image Import.

Voice Morphing is the default page when opening the program. Loading a preset is as easy as selecting from one of the pull-down menus at the top of the interface and scrolling to a sound. Four voices can also be loaded at once. Clicking on the voice name drops down a menu to let you select any of the Cameleon's individual voice presets. The main attraction to the Morph page is its center Morph Square, which graphically depicts how the voices are morphed depending on which parameter controls them at the time. The Timeline is one method, and the Morph Mode button allows morphing through the voice's Harmonics, Noise, Amplitude, or a combination of all. There's also a Random Morph button for completely random settings that can produce new sounds with a quick click. Imagine being stuck

CAMELEON 5000

STATS

CAMEL AUDIO
Wellcote, Church Lane
Eardisland,
Herefordshire,
HR6 9BP, U.K.
+44-07740-468827
suppport@camel
audio.com
www.camelaudio.com

PRICE
$199

SYSTEM REQUIREMENTS

PC. Pentium III 1GHz, 128 MB RAM, Windows 98/ME/2000/XP, VSTi/RTAS host.

Mac. G4 733 Mhz, 128 MB RAM, Mac OS 9/X, VSTi/Audio Units/RTAS host.

PROS

1. Great presets.
2. Ability to morph or process imported audio and bitmap files into sounds that are very original.
3. As easy or as in depth to use as you make it.

CONS

1. Uses a good chunk of CPU power.
2. Doesn't actually import AIFF or WAV files but re-synthesizes them. This can be great for creating new sounds, but may not give the exact results you expect.
3. A little thin on punchy bottom with some presets.

for an exciting new effect or pad, and loading your sound files into the Cameleon's Morph page. In seconds you can turn an unexciting sound into an original effect no one's ever heard before.

The Effects page is where the Cameleon can further manipulate the sounds by adding Delay, Reverb, Distortion, Resonant Filters, Chorus, Formant Filter, and a Random Effect button for creating random effects with the Effects parameters. Effects are the last part of the Cameleon's sound chain, and each effect can be switched in or out individually as needed.

The Mod Page is for mapping control sources (Velocity, Aftertouch, Key Position, and so forth) to modulation targets such as attack, volume, timbre brightness, morph directions (X/Y), and LFO Rate. The list is extensive and it would take half a page to name them all. This makes for powerful and extensive modulation control of practically every parameter in the Cameleon.

The Easy Page, as mentioned earlier, is a good place for the first-time user. It offers basic controls of main parameters like Timbre, LFOs, Voices, Amplitude Envelopes, and Output. A Random Easy button is also available to shift parameters around in random patterns, creating new sounds in the easiest way imaginable.

Sample Resynthesis is one of the Cameleon's unique features, in which samples in WAV or AIFF can be imported as a Voice Program, but in an extremely innovative way. Samples are not actually loaded into the program; the Cameleon examines the sound using something Camel Audio calls Sonic Blueprint Technology, and the software creates a new Voice Program that actually imitates the sound. This is a great way to get sounds that would normally be impossible with a conventional sampler. This obviously saves time and space by not loading the actual samples. The manual offers suggestions on importing samples so that Cameleon creates the most realistic imitation. Sample resynthesis opens up ways to explore the Cameleon's design tools with any sound effect or music file. Once sounds are synthesized into the Cameleon, they can be edited and morphed with other sounds.

Sample and BMP/ image import translates image files into sounds. Apparently, the process is quite complicated, and I believe it. I've experimented with audio software that imports images for sound, using a process in which the images are treated as a graph with X and Y representing time and harmonics. Even pixel brightness affects how the program reacts to images, in this case, representing volume. This process of image importing can create truly unimaginable sounds.

SYNTH CORE

The Cameleon is also a powerful additive synth at heart, including a multi-band noise generator that permits complete control of the synthesis procedure. Camel Audio suggests that this method of sound creation may not be the easiest to master, and some might prefer the ease of importing and editing sample files. In the old days, you selected a Waveform like Sine or Sawtooth to create sounds from scratch. The Cameleon takes this further by allowing control over individual harmonics, amplitude, and noise to design new sounds. Learning to model sounds from scratch with the Cameleon's additive tools gives you extensive control over every step of the creation process.

There are many other parameters to the Cameleon that shape and sculpt the final output. Micro-tuning, harmonic and noise presets, filters, multi-sampling and velocity layers are just a couple of the tools available to the novice and serious user. The Cameleon can be as simple or complex as you need it to be, which makes it an amazing tool for creating and editing sounds and patches.

THE SHAPE OF THINGS TO COME

The programming power that the Cameleon has to offer also can't be ignored. The program is well suited for developing interesting effects and background SFX loops as well as ambient themes for game soundtracks or intro movies. The Cameleon is especially good at pads and rhythmic or pulsating music, like techno or trance, which is heard throughout many action or first-person shooter games. You can quickly create pads that are lush and warm for adding subtle atmospheres, or powerful in your face themes with synced delays and modulations, for intense panning effects.

The presets are pretty amazing and very useful for the most part, especially as starting points for making new sounds. Some of the sounds, particularly percussion types, are not quite as useful, and could use some low-end punch, but most of the other sounds are quite good. It's easy to jump in and build on the presets to create incredibly imaginative sounds. You can make unthinkable landscapes with the touch of a mouse, but you can just as easily get lost in the Cameleon if you don't watch what you're doing. One minute you're amazing yourself, and the next you could be wishing you had left well enough alone. Musicians and effects designers should certainly experiment with the Cameleon tools, but also eventually learn how to use them properly because there's a lot to work with.

Camel Audio has succeeded admirably in creating a soft synth that's easy to use right out of the box and incredibly deep for the advanced technician. It seems like a good fit for game work, although according to officials at Camel, game studios aren't yet on their roster of clients (the company primarily deals with film studios at the moment).

The Cameleon is capable of manipulating sounds in ways some of us have never imagined. The ability to work with different methods of sound sources whether its imported samples, images, or from scratch makes this a very powerful tool for the musician and sound designer. I recommend trying the Cameleon 5000 and I imagine that it will soon become popular in most audio toolboxes. ⁙

GENE PORFIDO *is an independent musician and sound designer currently living in San Francisco. You can reach him at* ***gporfido@gdmag.com****.*

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jill duffy

GAME DEVELOPER'S 4TH ANNUAL SALARY SURVEY

NEW CONSOLE DEVELOPMENT, IN 2004, WAS OLD NEWS. BUT THAT DIDN'T stop the money from rolling in. Retail sales figures for video game software have flourished, reportedly reaching somewhere between $2.9 billion and $7.3 billion, depending on how computer software is counted. Electronic Arts and Activision have shown strong growth in the past year, with THQ, Square-Enix, and Ubisoft also showing impressive results.

In addition, the massive growth of the online and mobile gaming markets in North America, and the rise of ancillary markets such as serious games, are also spurring the industry on to greater heights.

In short, there's money to be had—but who's making it?

For the fourth year running, *Game Developer* conducted a salary survey across all disciplines of the game development community in search of an answer. This year, we've included previously forgotten players of our industry: business and legal. Think executives get the lion's share? In this year's survey, you can size up the top dogs' salaries against your own earnings as well as peek at the figures your colleagues make, or perhaps, should make.

ILLUSTRATION BY MATT TIMSON/THREE IN A BOX

METHODOLOGY

With the help of research firm Audience Insights, we sent email invitations to *Game Developer* subscribers, Game Developers Conference 2004 attendees, and Gamasutra.com members in January 2005 inviting them to participate in our annual salary survey.

Although we received 3,913 unique responses worldwide, not all who participated in this survey provided sufficient compensation information to be included in the findings. We also excluded cases in which the compensation was given at less than $10,000 or greater than $300,000 or if there was text entered that did not readily correspond to a compensation figure. We further excluded records missing key demographic and classification information. Finally, this report is of the U.S. compensation only, excluding approximately 1,389 otherwise valid respondents from outside the U.S. So the total sample reflected in the compensation data presented in the following pages is 2,091, smaller than the original number of respondents, but still very comprehensive.

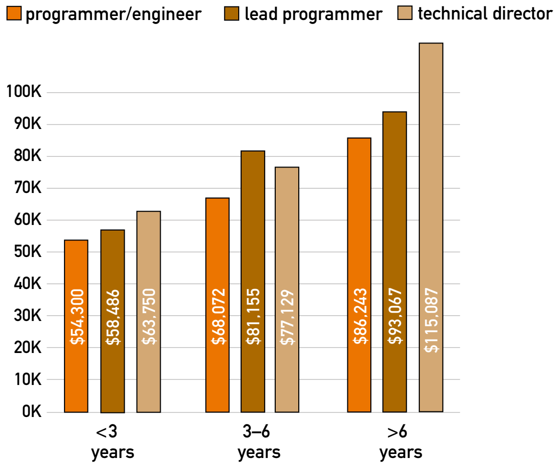
The sample represented in our salary survey can be projected to the overall game developer community with a margin of error of plus or minus 2.1 percent at the 95 percent confidence level. The margin of error increases for specific subgroups reported within this community.

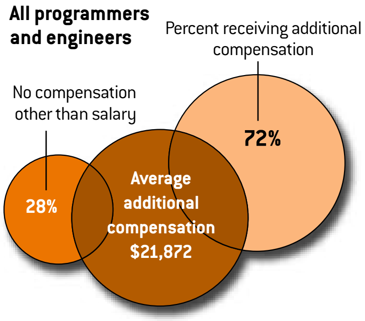
PROGRAMMING

NO MATTER THEIR SPECIALIZATION—AI, PHYSICS, GRAPHICS engine, networking, and so forth—programmers continue to earn relatively more than developers of all other disciplines across all levels of experience. This is especially true for industry veterans of six or more years, likely due to the rarity of experienced console engineers.

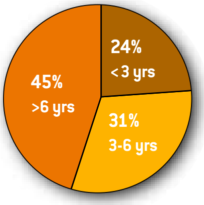
Interestingly, salaries for the least experienced programmers dipped somewhat compared to the previous Salary Survey, possibly due to a proliferation of college graduates moving into an ever-increasing raft of entry-level positions, as well as existing programmers becoming older, more seasoned, and thus shifting brackets.

Programming salaries per years of experience and position





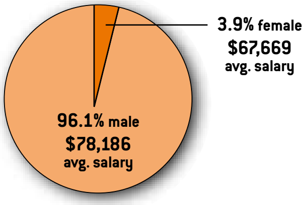
Years experience in the industry



Type of compensation

Annual bonus	53%
Project bonus	25%
Royalty	23%
Stock Options	44%
Profit Sharing	21%

Average salary by gender



Highest salary
$211,500

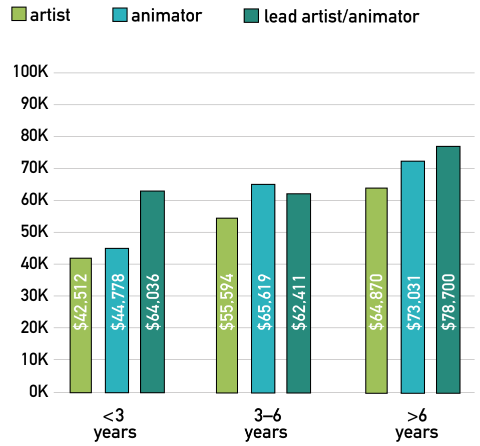
ART AND ANIMATION

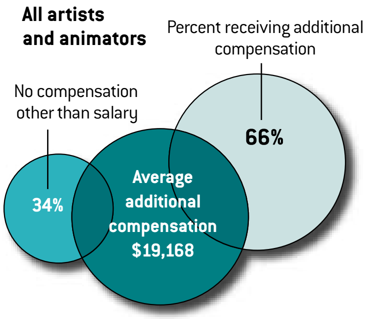
LEAD ARTISTS/ANIMATORS REPORTED THAT THEY MADE significantly more money in 2004 than 2003 across all levels of experience, but the increase was particularly fruitful for animators with three or more years experience; for those straightforwardly titled "artists," salaries increased only marginally.

Also, though some artists worry about burnout, it's clear that many are sticking around. Forty-four percent are veterans of six or more years, compared to just 37 percent last year.

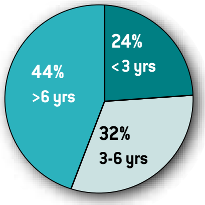
Finally, although artist salaries generally come in at significantly less than coders' for those with similar experience, the highest individual salary for any artist was $220,000, beating out the top programming salary of $211,500.

Art and animation salaries per years of experience and position





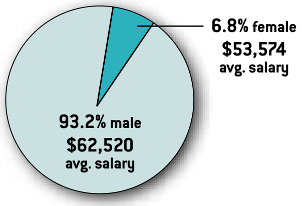
Years experience in the industry



Type of compensation

Annual bonus	53%
Project bonus	31%
Royalty	37%
Stock Options	35%
Profit Sharing	16%

Average salary by gender



Highest salary
$220,000

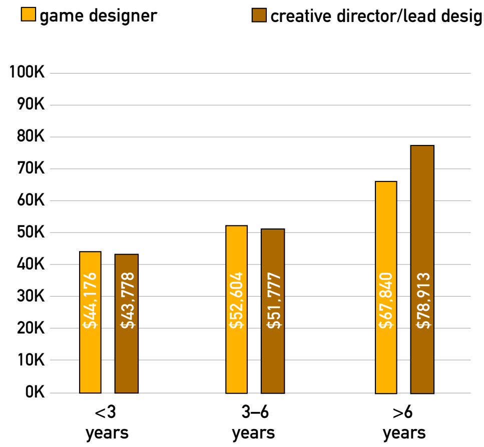
GAME DESIGN

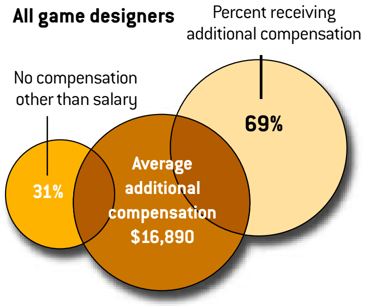
"I WANT TO MAKE VIDEO GAMES WHEN I GROW UP."

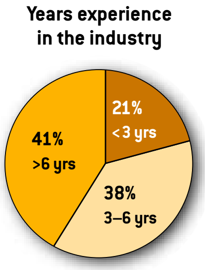
For the bright-eyed, prepubescent children who make this statement, it loosely translates to "I want to be a game designer." (Here, the term comprises game designers, level designers, and writers.) The job sounds idyllic to those not really in the know, but it's competitive as hell. College graduates (or even talented drop-outs) vying for a position as a game designer will find adequate entry-level salaries as a result of the competitive nature of the title. Increases in pay tend to be more commensurate to experience than title, at least for the first few years in the industry.

The best advice I've heard for budding designers: Find yourself an experienced mentor. Listening and asking questions of others might be the best way to negotiate the path between designer and lead, even if the pay is relatively static between titles.

Game design salaries per years of experience and position

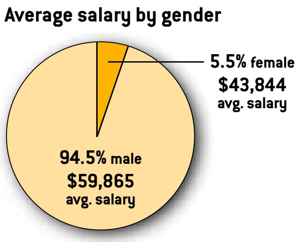






Type of compensation

Annual bonus	44%
Project bonus	32%
Royalty	32%
Stock Options	36%
Profit Sharing	26%



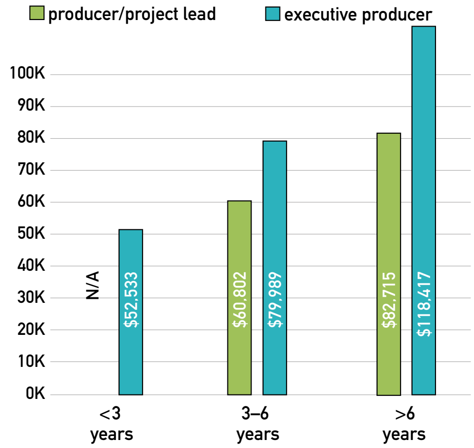
Highest salary
$190,000

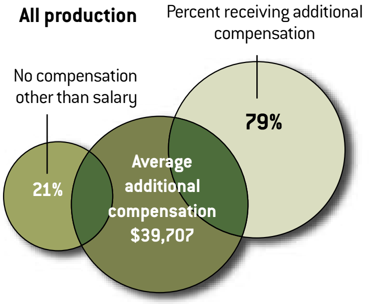
PRODUCTION

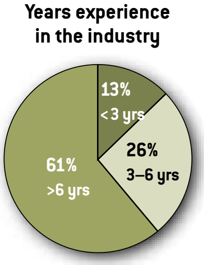
PRODUCERS ARE THE SHEPHERDS OF THE DAILY GRIND, managing all the details from relationships, to schedules and budgets, and make a pretty decent base salary. From our reported figures, producers who stick with it for at least six years will earn cushy payoffs for their time; and compensation other than salary is among the highest in the industry for this group.

But where do producers come from? It's been said in the past that the producer's title is what many QA personnel and support staff aspire to. But as the game industry stretches its wings in the entertainment sector, we could see more experienced professionals coming into games from other industries by using this directorial title to their advantage.

Production salaries per years of experience and position

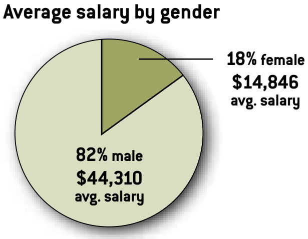






Type of compensation

Annual bonus	60%
Project bonus	25%
Royalty	29%
Stock Options	55%
Profit Sharing	16%



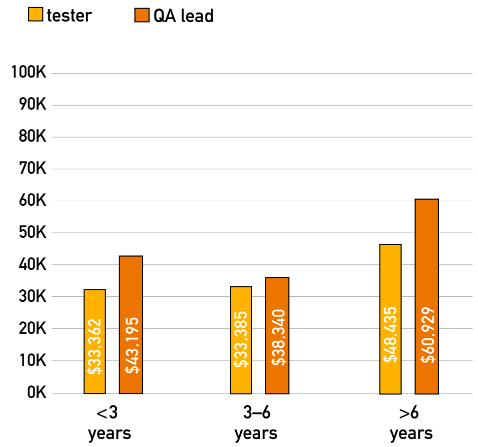
Highest salary
$210,000

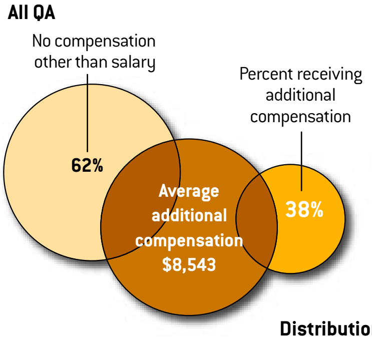
QUALITY ASSURANCE

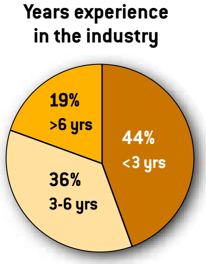
RESULTS FROM THIS YEAR'S SALARY SURVEY INDICATE THAT not everyone in the industry is rewarded for several years of service. QA employees who have been in the industry for three, four, or five years, on average, don't make much more than their fledgling counterparts. What's the message? That a rookie is as valuable as an experienced QA person?

Fortunately, there's an upside: QA has traditionally been a position in which non-technical game enthusiasts could get their foot in the door, and, antecdotally speaking, that doesn't seem to have changed much over the years—it's still an excellent path to game design and production-related positions.

QA salaries per years of experience and position



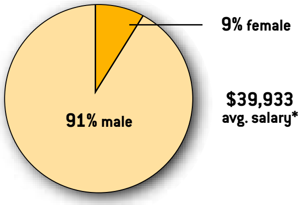




Type of compensation

Annual bonus	64%
Project bonus	10%
Royalty	10%
Stock Options	44%
Profit Sharing	15%

Distribution of gender



Highest salary
$225,000

*Average salary by gender N/A.

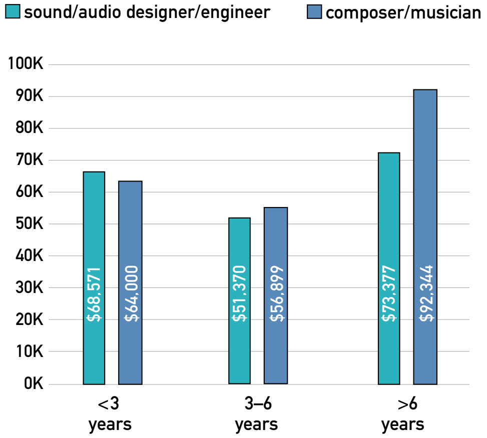
AUDIO

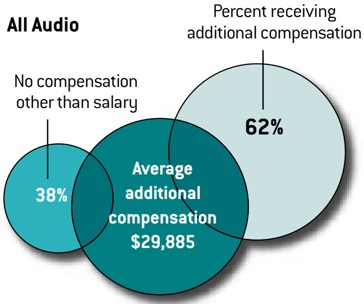
LICENSING MUSIC IS IN. OR IS IT?

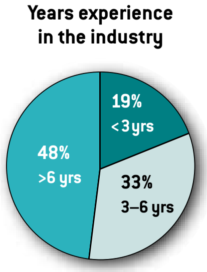
Experienced audio engineers and musicians, directors, and composers this year have recorded their salaries as being markedly higher than last year, especially for entry-level musicians. Audio and musical people with more than six years experience can, in the game industry, make a salary on par with programmers with equal years of experience.

Unfortunately, we received the fewest number of (usable) responses from people in the audio category: a scant 63, perhaps reflecting the fact that many musicians don't work solely in games. Additionally, so few lesser-experienced audio recruits responded that it discourages a deeper analysis of wages in this discipline.

Audio salaries per years of experience and position



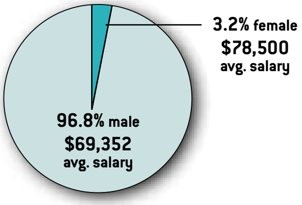




Type of compensation

Annual bonus	46%
Project bonus	49%
Royalty	49%
Stock Options	35%
Profit Sharing	24%

Average salary by gender



Highest salary
$225,000

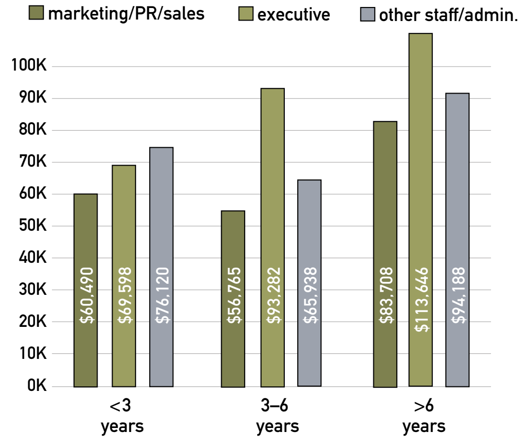
BUSINESS AND LEGAL

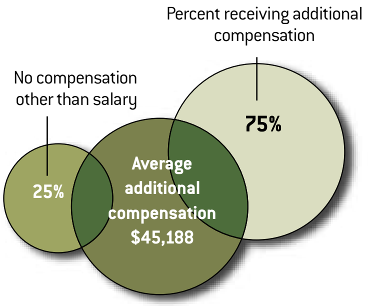
MATURATION OF THE GAME BUSINESS IS A SURE THING, AND AS IT expands, the scope of its people must also expand. New to the salary survey this year are respondents who classify themselves in the business and legal category—people who we must include in our community and game creation business plan, since without them, no thriving company would have a business plan at all.

For the purposes of the survey, business and legal breaks down into three groups: marketing, public relations, and sales; executive; and other staff or administration.

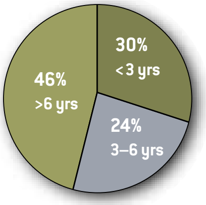
There are a surprising number of business and legal professionals who are acclimated to the game industry's unique climes. Their higher salaries might be attributed to commission or simply rank and file, in the case of executives. But like developers of all disciplines, these people usually know games, so let's not discount them just because they don't AI script like maniacs.

Business/legal per years of experience and position





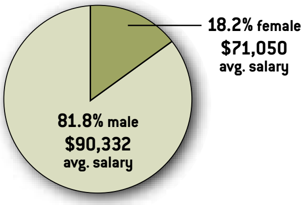
Years experience in the industry



Type of compensation

Annual bonus	56%
Project bonus	21%
Royalty	16%
Stock Options	46%
Profit Sharing	29%

Average salary by gender



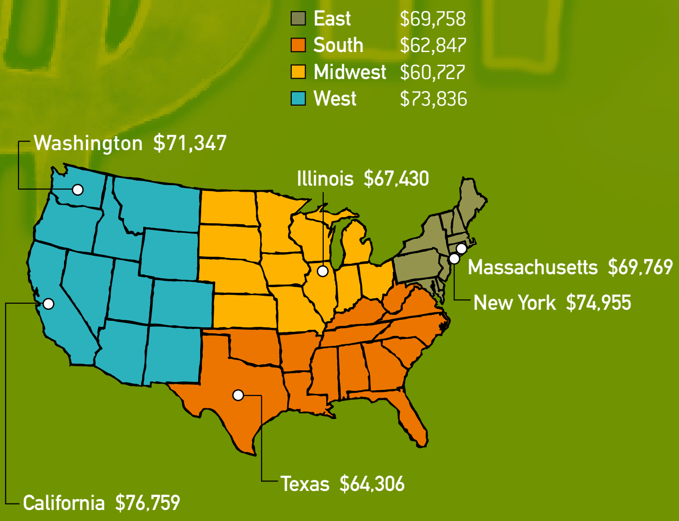
Highest salary
$256,000

NATIONAL TRENDS

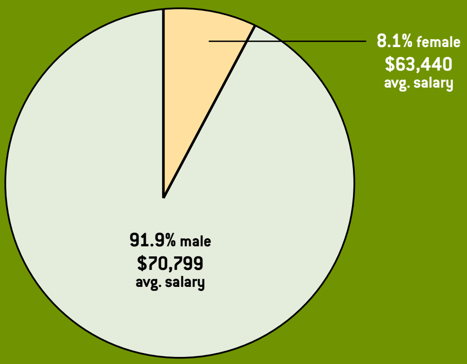
OF THE MAJOR HOTBEDS FOR GAME DEVELOPMENT BY STATE, salaries for Californians fared well, with the average at $76,759, up nearly $5,000 from last year's survey. This year, we've also added two average salaries by state, Illinois and Massachusetts, to better represent the Midwest and East regions, since a prominent number of respondents work in these states. Of the major states, salaries were lowest on average in Texas, although we can likely attribute this to the lower cost of living.

In terms of location, we could start to see more studios cropping up or thriving in some unexpected (or at least less anticipated) places. We had more than 30 respondents who reported to work in each of the following states: Utah, Maryland, Virginia, Florida and Oregon.

Females accounted for little more than 8 percent of all respondents in this year's survey, a marginal 1 percent increase over last year's turnout. But their salaries are reportedly closer to males' this year than last in game development-related fields, with females on average earning $0.90 to the dollar. Last year, the outcome was slightly lower at $0.87 per dollar; and for 2002 salaries, $0.89 per dollar.



Overall average salary by gender



>> evan shamoon

EVERYTHING YOU NEED TO MMO

NEWCOMERS TO MASSIVELY MULTIPLAYER online games—be they publishers, developers, investors, or even players—are quickly discovering the world they've entered into is equal parts brave and new. The dips, eddies, and peaks in the recent past; booms, cancellations, and unexpected hits, have left even many insiders confused about where the MMO market is going at any given point.

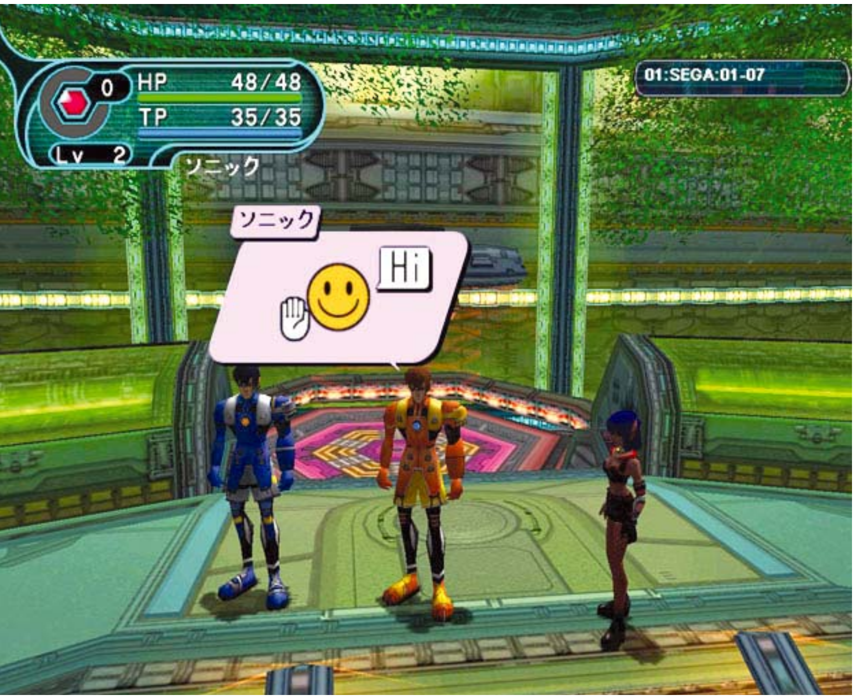
Perhaps the most interesting thing about MMOs as a whole is how they constantly buck trends and behave perversely, in fact, almost inversely, compared to the rest of the game market. Checking out of the console boom? MMO titles are big on the otherwise borderline-stagnant PC market. Confused about why your local venture capital firm won't put money into your friendly neighborhood console action game developer/publisher? The MMO market is siphoning off all the venture-capital gaming cash into its own not-so-little stash. Fed up with making ever-more complex games for the same $50 price point? MMO monthly subscription prices have risen more than 30 percent in the last couple of years, giving significantly more funding for expansion, maintenance, and perhaps even profit along the way.

EVAN SHAMOON, *a freelance writer based in San Francisco, has previously written for publications such as* Wired, Official PlayStation Magazine, Res, *and* 1UP.com. *He can be contacted at* ***eshamoon@gdmag.com***.

What can industry veterans and newcomers alike learn from MMOGs, and how is the MMO revolution a harbinger of things to come, as more online connectivity and more persistent data floods the gaming market as a whole?

THE MMO AND THE CONSOLE WENT TO SEA ...

The PC game market, at least in North America, is dwarfed by that of consoles. In 2004, NPD calculated that game console software sales climbed to $5.2 billion (160.7 million units), whereas PC game sales only reached $1.1 billion (45 million units). Yet, in the persistent MMO market, the PC is utterly dominant, even in console-hungry North America. Sony's PlayStation 2 has thus far played host to only two MMO titles, EverQuest Online Adventures and Final Fantasy XI, both of which have not exactly flourished in their sofa-centric form (although the PlayStation 2 version of Final Fantasy XI does fairly well in its native Japan). Indeed, the Xbox, a console that has essentially adopted an online gaming mantra with its pioneering Xbox Live service ("It's good to play together"), is more than three years into its lifecycle and has not yet seen a single MMO dance upon its silicon, despite the long development of titles such as the now-canceled True Fantasy Live Online.



Phantasy Star Online's universal symbol system.

There are many explanations for the disparities among the various games and consoles, of course. One of the largest and most obvious problems, at least for the world-dominating PlayStation 2, is that players must purchase a separate hard drive to play Final Fantasy XI, which results in a lack of installed base and inability to actually play the MMO title easily. (Square-Enix had trouble publicly containing its annoyance when Sony recently released the slimline PlayStation 2 minus the necessary hard drive and any ability to plug the FFXI-bundled HD into it.) Potentially major piracy problems for both the Xbox (which has a built-in hard drive, and the ability to upgrade it) and PlayStation 2 (which has seen tools to allow "backups" of games to an add-on hard drive) no doubt contributed to Sony's no-HD decision. It's not even clear whether next-generation consoles will have a built-in hard drive, even though it's technically and monetarily possible.

Funcom product director Jorgen Tharaldsen, who helped Anarchy Online win more than 700,000 registered users so far in its three-year existence, argues that the kind of MMOs his company develops grow much more organically if there's a simple method for adding content via download.

"In regard to having MMOs without hard drives, I think almost anything is possible," Tharaldsen says, "but is it wanted? The content updates and fixes the developers can add during the lifetime of a game keep the title fresh and alive, while giving the community something to look forward to. If you want to run the form of MMO games we know today, I think you must opt for local storage."

Bill Roper, former vice president of Blizzard Entertainment and CEO of fledgling developer Flagship Games, goes a little further toward identifying the problem and a possible solution.

"You can play an MMO without a hard drive if you don't intend on providing large amounts of content over time," Roper says. "This is one of the fundamental draws of the MMO experience, though, so it would be a neat trick of design to keep players paying monthly fees without a stream of content. It may be possible to find other ways to keep the game fresh, changing purely from the server side of things, but this would mean that the developers would need to plan a lot out in advance to ensure that any 'new' content that showed up during the game was already on the CD when you bought the game and was unlocked by other events."

New content isn't the only thing Roper believes rests in the hands of developers. "Other ways of supporting MMO play without a hard drive are out there in the fertile minds of developers, and we'll have to see what other types of peripherals are available. If my Xbox 2 has a USB drive where I can plug in a flash drive, that could be a fine solution—especially if a small pocket drive is a part of what you get when you buy the game."

Apart from the obvious storage issue, MMO gameplay relies heavily on detailed conversation, which means the console is at a stark disadvantage primarily because it lacks a keyboard. Borderline MMO titles such as Phantasy Star Online for the Dreamcast tried to adapt "universal symbols" on controller hotkeys for consoles lacking unwieldy add-on keyboards, but apart from providing an interesting cross-cultural bridge, they didn't exactly solve the problem.

Yet Micro Forté CEO John DeMargheriti, whose action-MMOG Citizen Zero is slated for release on PC and Xbox in 2005, argues that the already popular headset communication method will be one of the keys to the console MMO revolution. "Voice-chat will be the preferred mode for console MMOGs once a real console MMOG hits the market. For the PC, the keyboard is still the preferred mode of communication," he says.

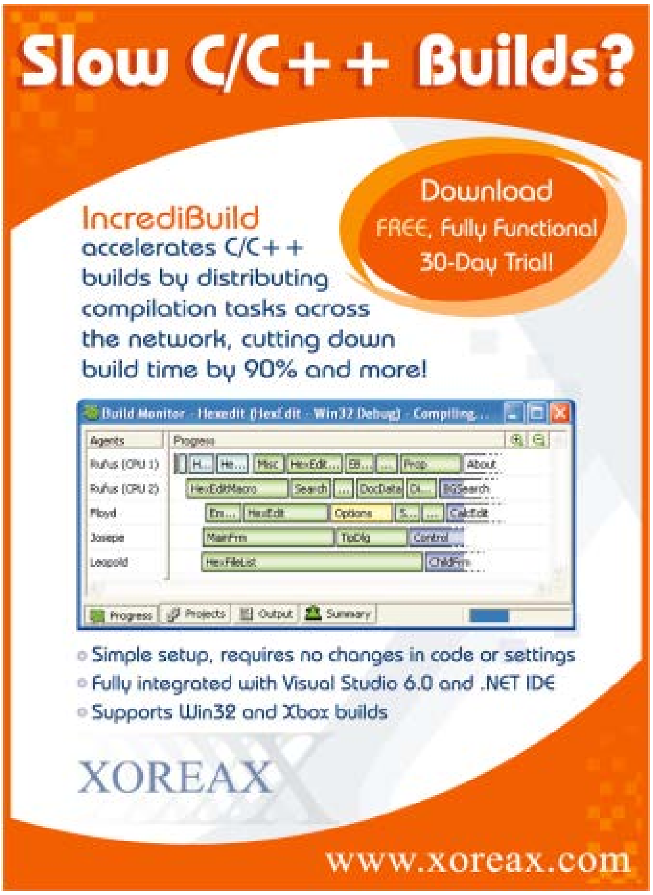
However, how and when a keyboard is used is often more of a social or cultural issue than a hardware one. "The interesting thing is that someone who speaks poor English finds it easier to type bad English and communicate than use a voice-chat feature," DeMargheriti says. "Also, voice-chat tends to take away from the role-playing experience." Still, he contents that the voice-chat will win out in the end. "Having said that, voice-chat is here to stay and you will find it taking more of a hold as a faster way to communicate and co-ordinate activities on the fly."

Regardless of these significant technical challenges—and perhaps unsurprisingly—nearly everyone interviewed for this article sees huge opportunities for MMOGs on next-generation consoles and expects that significant cross-platform development will occur during the next console hardware cycle.

But will the console MMO be an entirely different beast to the high-subscription-cost PC MMOG?

If we look at things this way, the complex online modes of games such as Microsoft's MECHASSAULT 2 may be a stepping-stone to the console MMO of the future. However, it's questionable whether people will pay $15 per month to subscribe, given the "more action, less content" schema. With only a controller and voice-chat to potentially play with, this is one of the key questions for both sides.

Turbine Entertainment's DUNGEONS & DRAGONS ONLINE.



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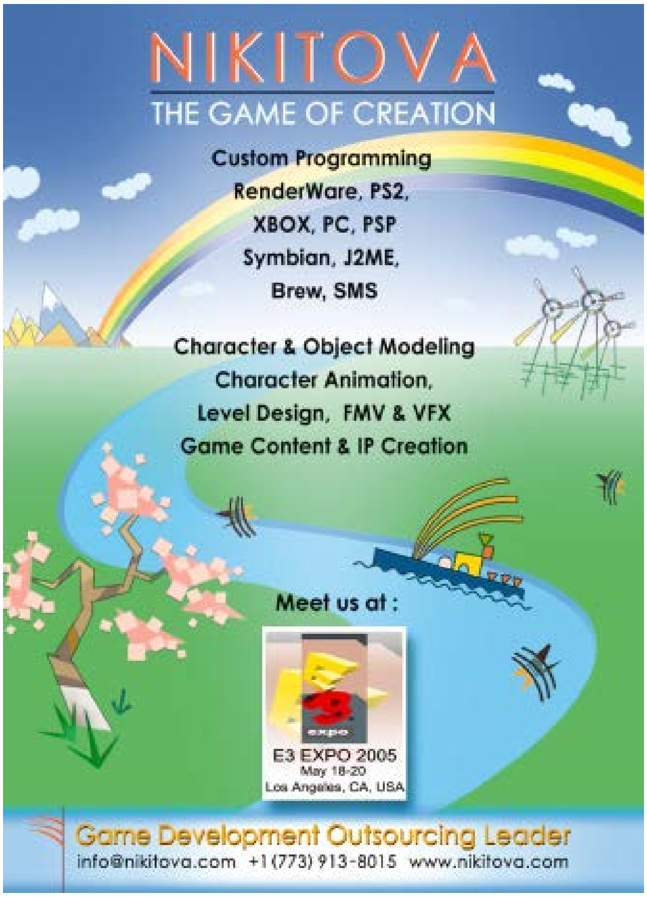

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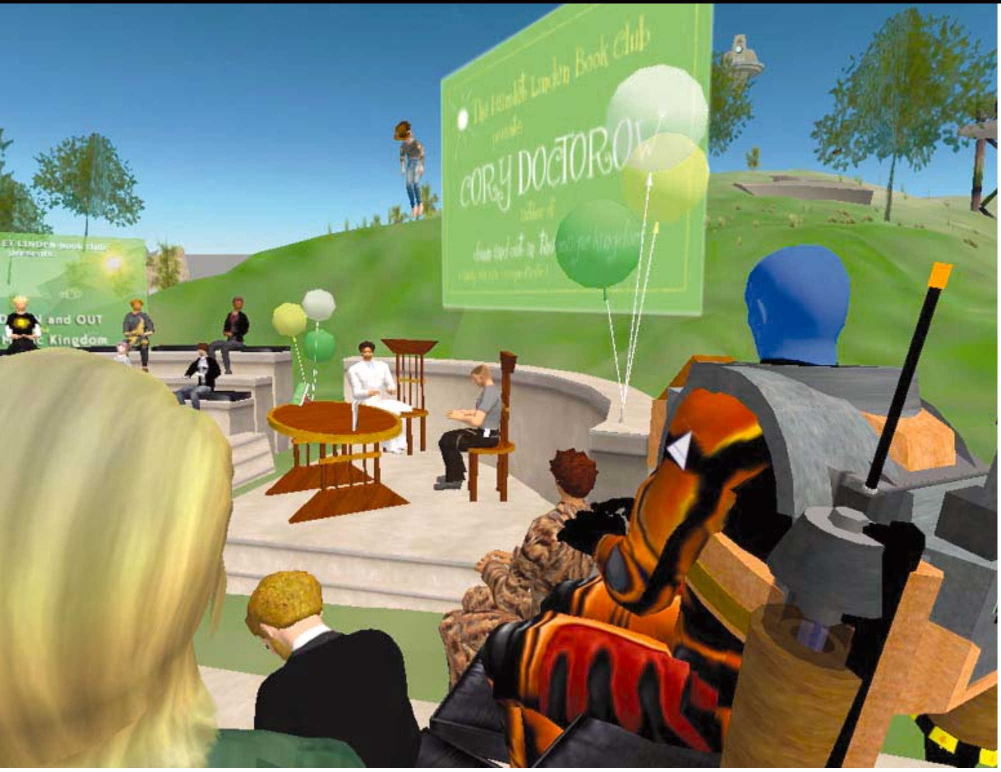

Second Life players hold a virtual book reading.

(AD)VENTURE CAPITAL

In the conventional game industry, venture capital funding simply doesn't happen. In a hit-driven business, venture capitalists find the game business too risky, with almost no exceptions—except, of course, in MMO development studios. These studios are genuinely starting to find funding sources from some of the larger venture capital investments; recent recipients include forthcoming *Star Trek* MMORPG creator Perpetual Entertainment as well as Asheron's Call and Dungeons & Dragons Online/Middle Earth Online creators Turbine Entertainment.

Perpetual landed a $6.5 million equity investment led by Softbank Capital in September 2004, following a $4.5 million investment by Manitou Ventures and Mobius Venture Capital in late 2003. And Turbine got $18 million in December 2003 in a round of financing from Highland Capital Partners, Polaris Venture Partners, and the company's existing investors.

Bill Gurley, a noted venture capitalist at Benchmark Capital with a keen eye on the MMO space, recently dropped several million dollars into Linden Lab's Second Life, a generally non-violent game in which players pay for their own plot of virtual land (512-square meters costs $9.95 per month, while an entire island will run you $195 every 30 days).

Listening to Gurley speak, it becomes clear that one reason for this enthusiasm—quite opposite of venture capitalists who are generally reluctant to approach games—is that MMOs resemble a somewhat more familiar idea to tech investors: web-based applications.

"Recurring revenues," Gurley gives as his number one reason to invest in MMOs. "Everyone who's ever sold enterprise software knows it's an unbeatable business model." He also cites competitive protection and network competitors. "If you can build a system where the marginal user has a much better experience if you have a million users, that's hard to compete with. Ebay has that going for it. Yahoo! and Amazon launched 40 products to compete and it didn't matter," Gurley says.

Yet another reason venture capitalists might be interested in MMOGs is that they are a high risk/high reward gamble. "It turns out that the average successful MMO lives about five years, and then the sequels are very successful, so you're looking at 10-year protection," Gurley notes. "The success stories are phenomenal and incredible businesses."

RISKY BUSINESS

Second Life founder and CEO Philip Rosedale says MMO venture capital investments are riskier than some might think. "Most MMOs are title risks—the specific nature of the content or content licenses is likely to determine the success or failure of the overall business. For this reason, most venture capitalists have (I think wisely) not invested. It is very difficult to set milestones or measure progress against this kind of risk."

Rosedale also says that Second Life "is designed around the proposition that the company's value lies in delivering a platform on which content can be created by a large number of different content creators. This removes the risk on any specific title or content and opens the door to a new and very compelling business: creating the system on which many different kinds of content can be built."

However, the "build a universal platform" MMO method may be even riskier than having a marquee license front-and-center on your game. According to unofficial estimates from MMOGchart.com in early 2005, Second Life only has around 22,000 subscribers, compared to hundreds of thousands on the biggest MMOGs, and may be considered more of a slow burner while its technology platform matures.

In any case, the recurring revenue angle to the MMO phenomenon ameliorates enough risk that venture capitalists often consider investing when presented with a compelling hook on top of the game's premise, a massive step up from what most other game companies endure. Perhaps as a result more conventional game companies will learn that cutting out the publisher middle-man and charging customers directly and digitally—whether for a subscription, additional content, or a digital download of a standalone product—is not only better business, but puts developers in control and put venture capital money within their grasp. Venture capitalists, remember, speak the language of "click to buy" more fluently than "bricks and mortar" shenanigans.

SUBSCRIBE

Conventional gaming has a major problem right now, says Flagship's Roper. "We're living in an amazing marketplace where a game that takes a team of 100 to 200 developers has movie-quality cinematic sequences, complete musical soundtracks and hundreds of sound effects, massive amounts of gameplay, and, increasingly, dedicated online gaming destinations, is available for $50. I say this is amazing because 10 years ago, games on the console systems cost $75!"

Still, the question remains: What's different in the world of MMOs? One difference is that the game's monthly subscription price point can change at any time. For example, Mythic Entertainment announced in January 2005 that it would raise its subscription price for Dark Age of Camelot PC MMO players to $14.95 per month, a figure shared by most current mainstream MMOs. Mythic explained to its customers that, in order for the game and the company to continue expanding at the current rate, it would have to increase fees by two dollars per month, the first such increase in the game's three-year history.

In other words, MMO developers have an option to fluctuate the price they charge players. And the price change can even happen in reverse: Funcom decided to give away free subscriptions to the basic version of Anarchy Online, hoping to make money on the purchase of expansions and by in-game advertising, courtesy of Massive Inc., for free subscribers. In fact, it wasn't so long ago that the first wave of MMO games, including Ultima Online, charged just $9.95 per month, meaning the MMO market has increased its conventional subscription rate by 50 percent in a time when off-the-shelf titles have actually, in some cases, decreased in price.

As the poor console game publishers are stuck with their $50 price, resorting to ever-more complex special retail editions to justify price increases, MMO owners have the option to change the price that they charge and implement it quickly, for both expansion packs and subscriptions.

We're just starting to see moves toward this from non-MMO creators. BioWare now charges players directly (via its web site) for add-ons to NeverWinter Nights. Xbox Live uses a pay-to-download method for add-on maps for games such as Splinter Cell: Pandora Tomorrow, and there are schemes such as Valve's Steam content distribution system. But if you need to be connected to the Internet to play an online game, it's much easier to control the flow of information and money that results. This is why the MMO developers are way ahead of the curve, at least in terms of controlling how much money the consumer spends after they buy a retail box with the game in it.

However, Bill Roper, although not in the MMO

Ashcroft
Tarupong
Target
Elautise
Party

Tarupongは応援した。
Elautise：そうだね
AshcroftはElautiseと共に楽しい気分に浸った。
Elautise：レベル上げしてる？
Tarupong：してるよ！
Ashcroft：まあまあだな
AshcroftはElautiseを見てよろめいた。
Elautiseは腹を抱えて笑いだした！

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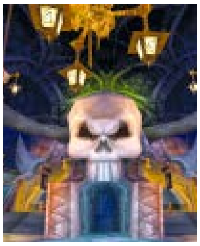
Warner Bros' The Matrix Online allows many to be The One.

field (he has explicitly said that Flagship's debut product will not be an MMO), is nonetheless considering the wider implications of controlling products with online subscriptions. "I think that this concept—paying for premium service that either lies beyond normal expectations in the field or provides a type of product that is markedly different than what you would normally get—has been successful in much more than just the MMO gaming space. Pay-television services such as HBO and Showtime provide new progressive programming that you just can't get on the networks," Roper says, hinting that other non-MMO games might some day follow a more flexible pricing model too.



TOWARD THE MAINSTREAM MMO

Stupendous things have been happening in the MMO space, and those young whippersnappers in conventional games could learn a thing or two from it. But what about the inverse? How do MMOs draw inspiration from conventional games in order to start approaching a market the size of conventional game?

The most obvious but vital area is content: what the games are about. For example, of the top 10 console titles sold in North America in 2004, according to NPD, seven were set in a contemporary setting, two (both Halo games) in a futuristic setting, and only one (the latest Game Boy Advance iteration of Pokemon) in anything that could be described as approaching a fantasy setting.

Thus, perhaps more certainly than anything else, a content stretch appears to be in the cards for MMOGs. Broadly, the medium has thus far found its primary niche on the fantasy end of the spectrum, to the tune of 75 percent occupying this elf- and orc-strewn milieu, while science fiction (including superheros) accounts for less than 20 percent.

"These are hugely disproportionate figures," MMOGchart.com's Bruce Woodcock points out, "especially when you compare it to other media like film or television, where science fiction generally does much better than fantasy in its appeal, *The Lord of the Rings* notwithstanding. The fantasy market is just very crowded right now, so you would think game companies would be looking to exploit other genres."

Publishers seem to agree. "I think we have to build experiences that are different than what we have seen to date in MMO gaming to draw in new customers," says Gordon Walton, vice president of development at Sony Online's Austin Studio. "Our gameplay has to become less hardcore and repetitive, and allow for shorter, more satisfying play sessions to reach beyond the hardcore gamer. That, along with the push to more mainstream licenses, will result in reaching beyond our current base."

And there have been casualties along the way. The naysayers effortlessly bang their drums and insist that the MMOG is in its death throes, citing several 2004 cancellations as ample evidence: Ultima X: Odyssey, Mythica, Dragon Empires, True Fantasy Live Online, and Wish. Each of those titles were canceled prior to release or full roll-out. Additionally, last September EA's Earth and Beyond met its untimely conclusion after roughly two years of existence.

But 2005 looks to fare better in terms of diversity, with games such as The Matrix Online, Imperator, Citizen Zero, Shenmue Online, Face of Mankind, Auto Assault, and City of Villains all slated for release. Certainly, the fantasy titles keep on coming: Guild Wars, Dungeons & Dragons Online, Middle Earth Online, and Vanguard: Saga of Heroes, to name a few. But all the publishers and developers we spoke with expect a major content shift in the months and years ahead, as MMO titles leap onto consoles and non-MMO games embrace at least portions of the pay-for-extra-content ethos that keeps the online game world ticking.

Indeed, the genre, though now fully birthed and finally walking upright, remains firmly in its infancy. These are early days, confirms Walton, who suggests that the cancellations, often in the crowded hardcore fantasy MMO arena, shouldn't be taken as a sign of the beginning of the end. "We're still at the beginning of the massively multiplayer online game phenomenon, and there is still room for original IP to create new franchises, in my view. The rush to existing licenses is driven by a desire to reduce risks, since the financial risks involved in the project sizes required for these games is so huge. If you want to compete, though," he says with a smile, "I wouldn't necessarily try doing in with a medieval fantasy setting."

Simon Carless contributed to this article.

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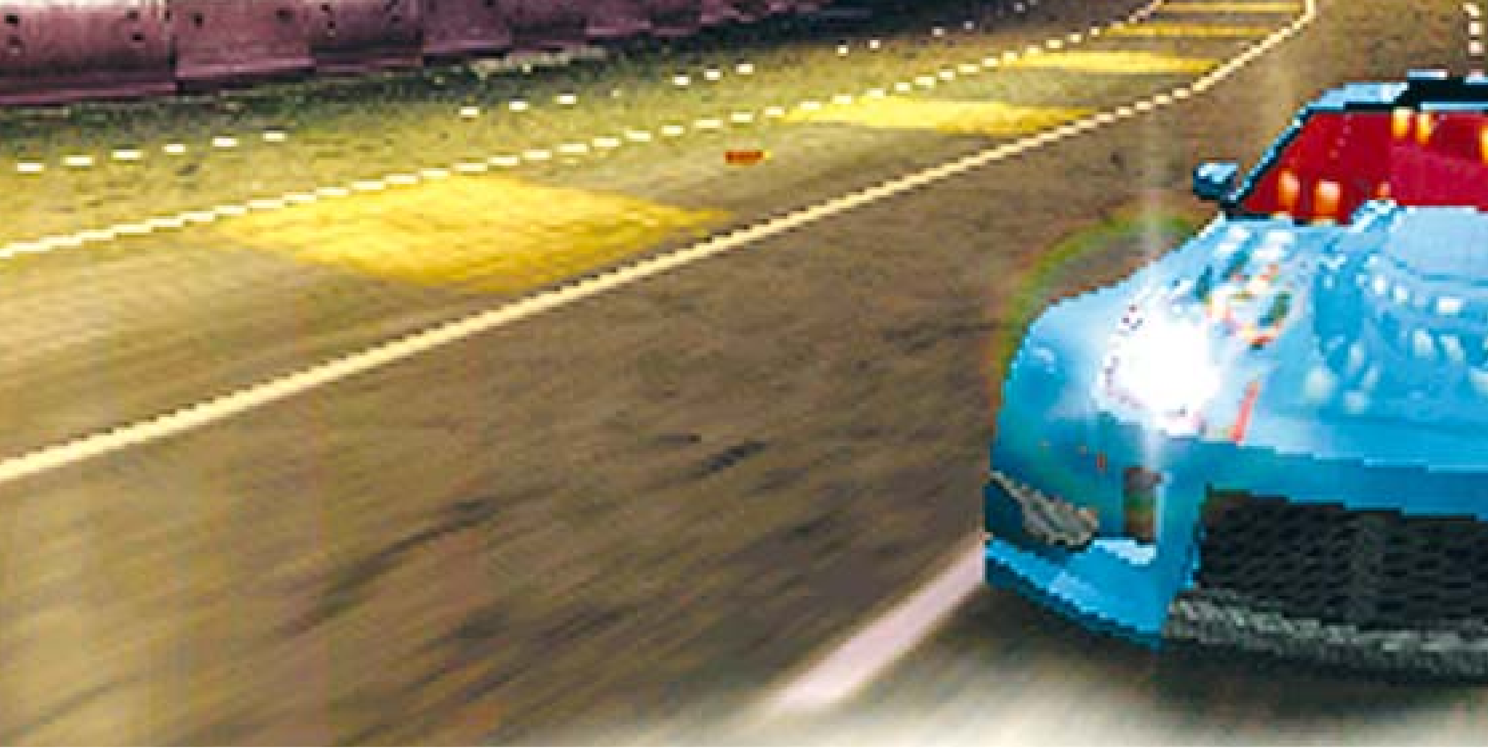

PSP PERSPIRATION

EA's Dave McCarthy discusses the unique challenges and capabilities of Sony's new handheld console.

BRANDON SHEFFIELD *is the assistant editor of* Game Developer, *and an all-around good guy. Email him at* ***bsheffield@gdmag.com****.*

TEAM FUSION, ELECTRONIC ARTS' NEWEST development group, which is housed largely in Canada, is an anomaly for the company. It's created from an amalgam of other teams and works on more than one specific franchise at a time, unlike the traditional model for EA's development houses. The new group, composed of more than 150 developers, works exclusively on handheld applications, most notably PSP and DS. For the March launch of the PSP, EA's Team Fusion has provided six titles: FIFA SOCCER 2005, MVP BASEBALL 2005, NEED FOR SPEED UNDERGROUND RIVALS, TIGER WOODS PGA TOUR, NBA STREET: SHOWDOWN, and NFL STREET 2: UNLEASHED. A six-game show of support is very impressive for EA, given the company's usual reluctance to enter into the handheld market. But with the recent rush of developer investments and license acquisitions, the company shows no sign of slowing down its expansion, even in portable gaming.

Certainly, launching any game on a new console is tough, but the PSP exasperates the difficulty due to its higher graphic and sound capabilities and associated higher development time and cost. Not only that, the PSP, while boasting a robust feature-set and specs, presents its own distinct development challenges.

Team Fusion producer Dave McCarthy spoke with us about how the company completed the six games, and more specifically, the ways in which the developers surmounted some of the console's particular development hurdles.

Brandon Sheffield: *Just how challenging was this launch for you?*

Dave McCarthy: I think the biggest challenge for us came at the outset. We create this organization, we bring all these people from all the best teams into one building and sort of get all these ideas floating around. The fact of the matter is, what we've been good at for a number of years as engineers or as designers, is making big games for big TVs, basically. I think the mistake could've been that early on we assumed that [developing PSP games] was going to be something pretty similar. One of the reasons we got into the PSP was simply because it can do a lot of things a console does, and we've hit this with all our products. You can get console level quality visuals, you can get those complex AI and physics simulations in the game, you can put a lot of content on a disc because the UMD has a lot of space, which cartridges didn't have in handhelds of the past. So you assume you're going to go "big console," which we have done with quality depth and visuals and such, but you can't just leave it at that.

One of the early lessons we learned was when we took small handheld TVs, (about 3 inches viewable in size), plugged them into our PS2s, and then soldered PS2 controllers to these small-screen TVs, effectively creating our own prototype PSPs. And what we had each of the guys do was sit down and play the respective games we were looking at. NEED FOR SPEED UNDERGROUND is an excellent example. You've got this street racing game at night that's been tuned for these beautiful TVs. We put them on these small screens, and in the case of a drag race for example, where you've got all this traffic whipping at you, you get five seconds into the race and—smash! All of a sudden you're hit. And you can't see where you're going when you're doing a circuit race, necessarily. So really early on in the design of these products we realized that everything we do had to be basically

Need for Speed Underground Rivals

re-factored to work on the PSP.

We had to change what we call the visual language of the game. All of the lighting has to adjust to make your eye concentrate on certain areas of the screen. We had to color-code things differently to get people to focus more on signage and other visual cues that would direct people on what to do.

We really had to kind of reinvent the basic experience, even with controls. Even though [the PSP] has a stick on it, it's not the same in terms of the precision as an analog stick you get on a console system, so we had to rethink how we would do controls. We had to obviously remap a lot of our sports games, for instance, because they work on dual analog controls, and we had to figure out a user friendly way to remap them so that they worked on [the PSP]. As a result, we have a bunch of unique features that you can only find on the PSP products. Beyond all that in terms of a development effort, we had to spend a huge amount of time on just figuring out how we designed the basic experience.

BS: *Tell me about the technical challenges.*

DM: One of the huge challenges for us is that all of our console games that we've taken, whether it be Need for Speed Underground, Tiger Woods, FIFA, NBA Street—all of those games rely on the streaming of the disc to populate the world. They run multiple streams on the disc at one time. So you've got a system for which streaming the disc is quite costly; it runs the battery down quickly. In fact, really the CPU almost grinds to a halt if you try to do more than one stream on there. We knew right off the bat that we needed to limit ourselves to a single stream in our games, which meant that not only were we redesigning everything to work on a handheld and all that jazz, we were also technically going to have to rebuild them differently because we wanted everything to fit in the RAM. We had to figure out a way to build these elaborate Need for Speed Underground cities in less than 32 megs of RAM.

The same thing happened with Tiger Woods golf courses. I mean, we rely on four or five streams on Xbox for instance (laughs)—it's constant to get the game going. We kind of all said, "Oh yeah, we don't want to sacrifice visual quality at all." Or content. So how do we get the same stuff on there without spinning the disc all the time? There was a lot of time spent behind the scenes figuring out how we use stuff, like instancing of objects in Tiger Woods, where if there's not a huge difference between some of the trees, we're actually instancing various types of trees to populate the forests that you see. With Need for Speed, buildings were built from a kind of Lego block of building sets, and again we instanced those buildings. But we light them and texture them differently, so you'd never be the wiser that we're doing it. You actually can't see the difference, but under the hood it's a lot cheaper and more efficient for us to do that.

We also had to carefully plan our audio that way. We'd go in and downsample some of the audio because you can't really tell the difference. At certain sampling rates, the audio doesn't really make a difference for the audience's perception. You'd have to be an audio expert, really, to know that we're sampling at a different rate. That allows us to compress the audio a bit, which gets us fitting in RAM again, because what we do is we load most of the banks into the RAM. We don't rely on streaming a lot. What we do is we run one slow constant stream in the background, and that allows us, if we've got music going in the front end for instance, to do just that. It's never having to do a seek. It's always in one disc location at a time—that sort of thing. Everything else is carefully downsampled.

Also, we would scope down; for instance in FIFA there would be five or six different types of noises going on simultaneously in gameplay and we'd say, "Well what really matters is chants. Chants are really important in football, so you need the big, loud chants in there. You need a ref's whistle, but you don't necessarily need the ambient chatter of the security guards in the tunnel, which is also what runs during [the console versions of] that game right now. Those audio sets are designed for that nine-speaker surround sound setup for the home. What we do is we focus on the effects that really matter for a particular franchise.

FIFA Soccer 2005 is on Electronic Arts' roster of PSP games.

BS: *How does the streaming of audio work?*

DM: In terms of the usage of music, it's just a standard play constantly for us, so in the front end it's just a looping sequence of tunes and again it's packed into the same area of the UMDs. There's no seek time involved, it just goes from one tune to the next, and anything else that's done is stored in RAM.

Let's use FIFA as an example: It'll have music running in the front end, and it'll just go from tune to tune to tune, and the stream is constantly moving there, so that doesn't hit your disc very hard, or run down your battery. It's actually extremely low-power consumption with that. Then when you get in the game, you hear the audio play-by-play, so John Motson and Ally McCoist would be again in the same area of the UMD, and able to just stream off that, and pick the samples and anything else is stored in RAM. Same with Tiger Woods.

BS: *Have you had any problems on the hardware side?*

DM: Not with the commercial hardware, but the bigger problem we had during development was with the dev kits. The early revs of the dev kits were very incomplete. I'll give you a practical example—the analog sticks on the early ones. We run a tool in all of our games to make sure the stick is calibrated correctly because we don't want you to be playing the game and then all of a sudden say, "Is the steering off on my Need for Speed car? Why is it veering to the right all of the time?" We would run these tests and find that if we had 10 kits, then the calibration was different on every single one of them. You would have a value of 1 on the left side, but 0.4 on the right side.

BS: *So what did you do to surmount that?*

DM: What we did was we said, "Well, we don't know that this is going to be a problem in the final retail units. This could be a dev kit only problem. But we're not going to take the chance."

Under the hood, we have an auto calibration module in the code. So it says if you're driving Need for Speed, it expects that you have a 1 for 1 ratio, so it will test your stick if you're moving it. You won't notice it when you're playing as a user. It's not like an option you have to select. Just the first time you race the game and power it up, we test to see what happens when you go far right or far left or up and down. What is the reading it's giving back to us? If it's not 1:1:1:1, we'll auto-calibrate our steering controls so that it effectively behaves as 1:1:1:1.

NBA Street: Showdown

BS: *Is that still a problem?*

DM: I don't know. We didn't want to take the risk. We can't tell now because we have that in our game code. I would rather be safe and not have us worry about it.

BS: *In terms of load times and battery, what kinds of solutions have you found, aside from what you're doing with streaming and RAM?*

DM: Load times have been, if you look at some of the developer forums, something of an early concern for us. All of our metrics show that UMD is considerably slower than DVD for loading times and seeks, which means that we've just had to do a bunch of smart things on the scenes. You have the ability to press two layers on the disc, so you have the ability to do a dual layer layout. Also, we know that some areas of the disc are faster than others. If you know that some areas are faster than others, and you know that there's some common data that you need to access, you put all of that stuff together on the same layer of the disc and you move everything into the fast zones of the disc. You're never going to eliminate the load times. I mean, UMD is always fundamentally going to be slower than DVD, and without a doubt there is nothing you can do about that. The transfer rate is what it is. But you can be smart about how you lay out things to try to get around that a little.

In Tiger Woods PGA Tour, developers saved space by instancing the scenery.

BS: *Do you foresee anything like minigames during loading screens?*

DM: Minigames during loading screens is actually patented by Namco, so they're doing it!

BS: *We know that UMD is slower than DVD, but what else must you keep in mind when porting PS2 titles to PSP? How much do you have to change?*

DM: You have to be smart about your RAM usage because you have to pretty much redesign all of those elements. You have to watch your audio stuff, and we factor that so that you're not streaming too much. You need to do stuff like different compression techniques for the UMD disc. You've only got 1.8 gigs. I use the example of something like Tiger Woods, where Tiger on Gamecube last year shipped on two discs, Gamecube discs being a comparable size to UMD. We wanted to get a similar number of courses and golfers on one UMD because we didn't think it was very practical to be swapping out. Doing different compression techniques makes sure that we can not sacrifice any visual quality and still fit on the UMD.

BS: *Do you have to lower your polygon count and textures?*

DM: Yeah, that's an interesting point—you do in order to fit in RAM. You have two bottlenecks you have to deal with, basically. You have RAM constraints, and CPU power. This is a great system in terms of its RAM capabilities, its visual output, even its streaming capability is decent. It's WiFi and all that. The one honest truth is that the CPU power is nothing close to the PlayStation 2. That's a challenge to know that you're trying to push console current-gen math through a processor that can't [handle it]. And that's why some of the games that are coming out are puzzle games. Or in the case of Ridge Racers, that's why they're running PlayStation One code through that system. It's basically a PSOne processor under the hood. But we didn't want to put PSOne games out.

BS: *How much do you feel you have to add to these PSP ports on the content side?*

DM: I think you need some form of added value for the consumer. The amount depends on the game. FIFA Soccer fans or MVP Baseball fans want the core experience at launch; they don't necessarily want you to create non-authentic teams or non-authentic stadiums. They want AC Milan, they want Yankee Stadium and all of those things they buy it for, so we offer them unique content. In FIFA, we give them some unique game modes that you can only find on PSP, or we'll give them unique music that we sign specifically for that. In all of our titles, we try to carry that consistently in that you will get some form of unique content and some form of unique gameplay on each of these games. And it really differs. Need for Speed Underground Rivals is almost completely new content. All the track environments are different, and not available on console. The cars even—there's a new set of American muscle cars in the game.

Sometimes you do it because you have to, but I think that we want to offer consumers some added value in these games. You don't want to squeeze a square peg into a round hole if it doesn't make sense. But in NFSUR, NBA Street Showdown for instance, we put two deep minigames that you can find only on PSP. But people are also going to play the device differently, so you want to make sure that you offer that different content.

BS: *With second-generation PSP games, what kind of improvements do you think we will see?*

DM: I think we're just scratching the surface about how to exploit the machine. I think you're going to have even visually deeper experiences as we figure out how to use the RAM layout better in products. I think that we're going to understand the UMD more and more so you'll get faster load times, you'll get more content on the disc. Much like PS2, when the first games came out it was like "Wow, these just look a lot better, and they're a lot deeper and contain more sophisticated AI and animation." It's the exact same story on PSP. It'll go through those steps, but I think it'll get better and deeper and a little bit more user-friendly over time.

The wireless internet capability will get more sorted out; they don't know yet what they're doing with their PS2 connectivity. The idea and the bones are there in the hardware to make it happen, but it's just not quite clear how it's going to work yet. ⁙

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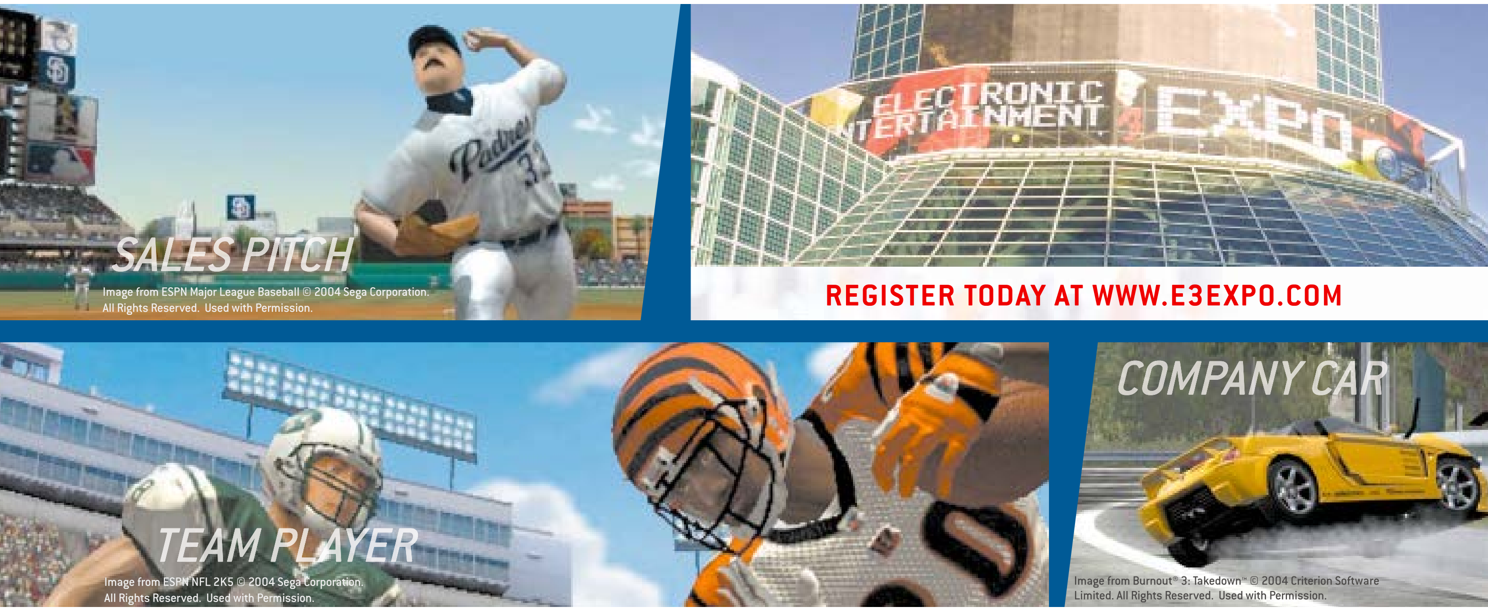

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CHOICE AND CONSEQUENCE IN STAR WARS: KNIGHTS OF THE OLD REPUBLIC II

ALTHOUGH THE ORIGINAL KNIGHTS OF THE *Old Republic* (KOTOR) was developed by BioWare, Obsidian Entertainment developed the sequel to the LucasArts game, *Star Wars Knights of the Old Republic II: The Sith Lords* (KOTOR II). Upon release, the original was met by both industry acclaim and consumer praise. The challenge for Obsidian was to attain the high expectations of such a game's sequel, while adhering to an ambitious development schedule.

In tackling this project, we decided to build upon the proven success of the first game's design and were careful to not fix aspects of the game that had already proved their worth. Instead, we identified areas of KOTOR that we could expand upon to create a better experience in a flavor similar to that of the first game. Almost without exception, every game design enhancement to KOTOR II was a natural extension from the original game, not a redesign.

KEVIN SAUNDERS *is a senior designer at Obsidian Entertainment. He was the lead designer and producer of Shattered Galaxy, which swept the 2001 Independent Games Festival. Kevin worked as a designer on Neverwinter Nights 2, Star Wars Knights of the Old Republic II: The Sith Lords, The Lord of the Rings: The Battle for Middle-earth, Command & Conquer Generals: Zero Hour, and Far Cry. He earned his Master's of Engineering degree from Cornell University and is currently writing an educational text on game interface design. Send comments about this article to* ***ksaunders@gdmag.com****.*

XBOX
STAR WARS
KNIGHTS II
GAME OF THE YEAR
THE SITH LORDS
OBSIDIAN

GAME DATA

PUBLISHER
LucasArts

DEVELOPER
Obsidian Entertainment Inc.

PLATFORMS
Xbox, PC

DEVELOPERS
33

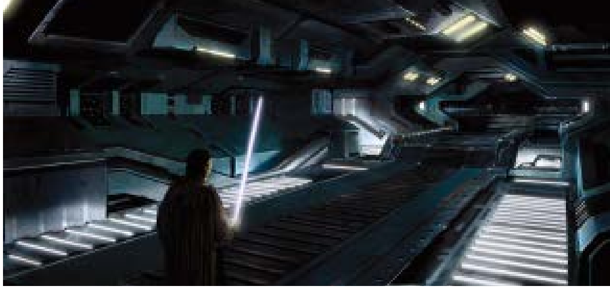
DEVELOPMENT TIME
14.5 months

RELEASE DATE
Dec. 6, 2004, Xbox (North America)
Feb. 8, 2005, PC, Xbox (International)

TECHNOLOGY
BioWare Odyssey Engine and Toolset

HARDWARE
Xbox Dev Kit
P4, 2.4-3.4 GHz, 1 GB RAM, NVidia 5700 Ultra or ATI Radeon 9800 Pro

SOFTWARE
3D Studio Max 3.1, 5, 6; Borland C++ Builder 5; Deep Paint 3D; Filemaker Pro; Impersonator; Mantis; Microsoft Office; Microsoft DirectX SDK; Microsoft SourceSafe; Microsoft Xbox XDK; Miles Sound System 6; Painter; Photoshop; Rad Game Tools Bink Video SDK



This project was Obsidian's first, though most members of the 33-person development team had several years of game development experience. About half of the team worked together at Black Isle Studios, while other members came from companies such as Blizzard, Electronic Arts, and Activision. About one third of the team was hired within the last six months of the project, including 70 percent of the design staff.

KOTOR II had dedicated producers on both the developer and publisher side, and all the members reported to one of three leads in art, programming, or design. The leads guided the development process, but gave considerable ownership to team members. BioWare provided the engine and toolset from KOTOR, which was the used as the foundation for KOTOR II. LucasArts provided all quality assurance, audio (sound, music, and voice), rendered cinematics, and also assisted in art asset creation. Most of the production phase of the project involved considerable overtime; however, employees were driven to work any extra hours not due to management, but due to their dedication to making a great game.

WHAT WENT RIGHT

1 **ALIGNMENT AND INFLUENCE SYSTEM.** The best example of expanding upon BioWare's strong game design is the influence system that Obsidian developed for KOTOR II. One of the most successful elements of the original KOTOR was its treatment of non-player character party members (companions). Their elaborate histories, personalities, and roles in the story were frequently praised as great features of the first game. Another powerful trait was the player character alignment system, the players' ability to earn light- or dark-side points for many of their actions.

Both of these elements were emphasized in KOTOR II. We expanded them by allowing players' relationships with their companions to change based upon the their decisions as the game progresses. When companions interject their own expertise or opinions during conversations, the player either gains or loses influence with that companion based on how they react to what was said.

The player's influence (either positive or negative) affects what types of information the companion will divulge and can even have more extreme effects, such as allowing the player to take on the companion as a padawan. Additionally, the player's alignment on either the good or evil side alters most of the companion relationships based upon his or her influence with them. Two of the prestige classes, Sith Lord and Jedi Master, had an even greater effect on their companions' alignments. The influence feature has been enthusiastically received by KOTOR fans.

We also increased the importance of alignment in other ways. Some of the dialogue, particularly from companions, changes when the player noticeably leans toward the light or dark side. A special lightsaber crystal attunes itself to the player's alignment and level, with its powers and abilities changing as the player does. The player's light or dark side decisions even effect who can become a player's companion.

2 **MEMORABLE MOMENTS.** Another aspect of KOTOR that received high praise was the non-linear game play. After completing the initial sections of the game, players were allowed to choose their own course through the game world. We sought to expand upon this idea by combining the non-linear aspect of the game with a philosophy of implementing memorable game moments. Often, what players remember from games are a few key moments that have great impact. Through cut scenes and innovative exploitation of the game engine, we created many of these moments throughout the game's story to continuously entertain and surprise.

Many of the events that occur in the game feel outside the scope of a traditional RPG, providing an experience that one normally doesn't find in the role-playing genre. For example, at several points in the game, the player takes the role of either a companion or a non-player character that's not in the party. These interludes allow you to experience different perspectives and to interact with the world in different ways. We felt this was also true to the *Star Wars* genre, shown in *A New Hope* and *Empire Strikes Back,* among others, as the "party" splits up to pursue different agendas.

We also emphasized the impact of the player's decisions. The influence system, as discussed above, is a primary example of how we actually did this. Another example occurs on Dantooine when the player learns of a impending conflict between the provisional government and some mercenary groups. You can take several actions to assist one side or the other, such as repairing the settlement's defenses or reprogramming them to fire upon friendly troops. Your decisions affect the battle that ultimately takes place in visible ways, and the conflict's outcome affects events later in the game. Many of the late-game elements vary considerably based upon the choices made throughout the entire game.

3 **AUTOMATED DESIGN SYSTEMS.** To improve balance throughout the game and to conserve design resources for content creation, we created semi-automated systems both for placing items and scaling non-player character difficulty.

In KOTOR, items were placed throughout the game, resulting in the same ones being found during every play-through. Because of the game's open-ended nature, the order in which items were found was unknown to the designer, which can reduce the entertainment value of finding the items. For example, if players find great armor fairly early in the game, they would be less interested in any armor found later.

In KOTOR II, we implemented a random item placement system. Every item has an effective character level for which the item was designed. Each area of the game, upon first entering it, is stocked with treasures appropriate for the player's level. We included a small random chance for a particularly powerful item and incremented this chance each time a powerful item was not found. When a powerful item was placed, this random chance was reset. This implementation

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Audience Award Alien Hominid, The Behemoth

Seamus McNally Gish, Chronic Logic LLC

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Innovation in Visual Art
Wik and the Fable of Souls, Reflexive Entertainment

Innovation in Game Design
Wik and the Fable of Souls, Reflexive Entertainment

Technical Excellence RocketBowl, Large Animal Games

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guaranteed the frequency of powerful items that we desired. We also could override the random factors to ensure, for example, that a key bounty hunter finds a powerful blaster rifle before he'll definitely need it.

The random item system helps ensure that players continuously find interesting items throughout the game. It also aids replayability since each play-through can yield different items. (A single play-through of the game might reveal about half of the total possible items.) Finally, by being automated, it was easy to make sweeping changes to item distribution and to add new items without requiring placed items to be rearranged. Plot-related items were still placed throughout the game.

A second automated system, called auto-balancing, was used for adjusting non-player character difficulty. In KOTOR, non-player character difficulty was, for the majority of encounters, static. Because of the open-ended world, this design created severe balancing challenges. Any given area might be traversed by either a level 8 character or a level 18 one. For KOTOR II, we used auto-balancing to both address this problem and to save design time.

Upon entering an area for the first time, the difficulty levels for all placed creatures are scaled based on the player's level. We differentiated between five degrees of scaling to meet various needs and used controlled tests to set the levels of difficulty to appropriate starting points. Auto-balancing was modest for common enemies so that you feel that they're consistently gaining power throughout the game. For bosses, however, auto-balancing was more extreme. We wanted to encourage players to try new tactics and use different items to defeat these opponents. Using it in this way, the auto-balancing feature ultimately saved considerable design time.

4 **ITEM CREATION AND UPGRADING.** KNIGHTS OF THE OLD REPUBLIC's item system allowed the player to upgrade some of the equipment they found. The upgradable items had between two and four slots for upgrades, depending upon the type of item. For example, upgradable armor could be reinforced with a mesh underlay. Except for lightsaber crystals, item upgrade options were very limited. You didn't have to make any choices involving the upgrades, and all upgradeable items were acquired fairly early in the game. In short, you only had to take a few extra steps in order to get your upgradable items to reach their full potential.

For KOTOR II, we added choices to the upgrade process. For example, you can now equip your armor with one of 30 underlays and overlays (though many of these are variations on each other). We increased the number of lightsaber upgrade slots from three to six. All told, KOTOR II has more than 200 upgradable items. We also made many more items upgradeable, so that finding them is the norm instead of a rarity.

Another improvement we incorporated was an item creation system. Almost every found item can be broken down into components. You can then use these components to create different items. Your skill level determines which items you can create. And while most normal items cannot be created, all upgrades (except for lightsaber crystals) can be. Additionally, most disposable items, like medpacs, mines, and grenades, can be broken down into chemicals, which can then be used to make other disposable items.

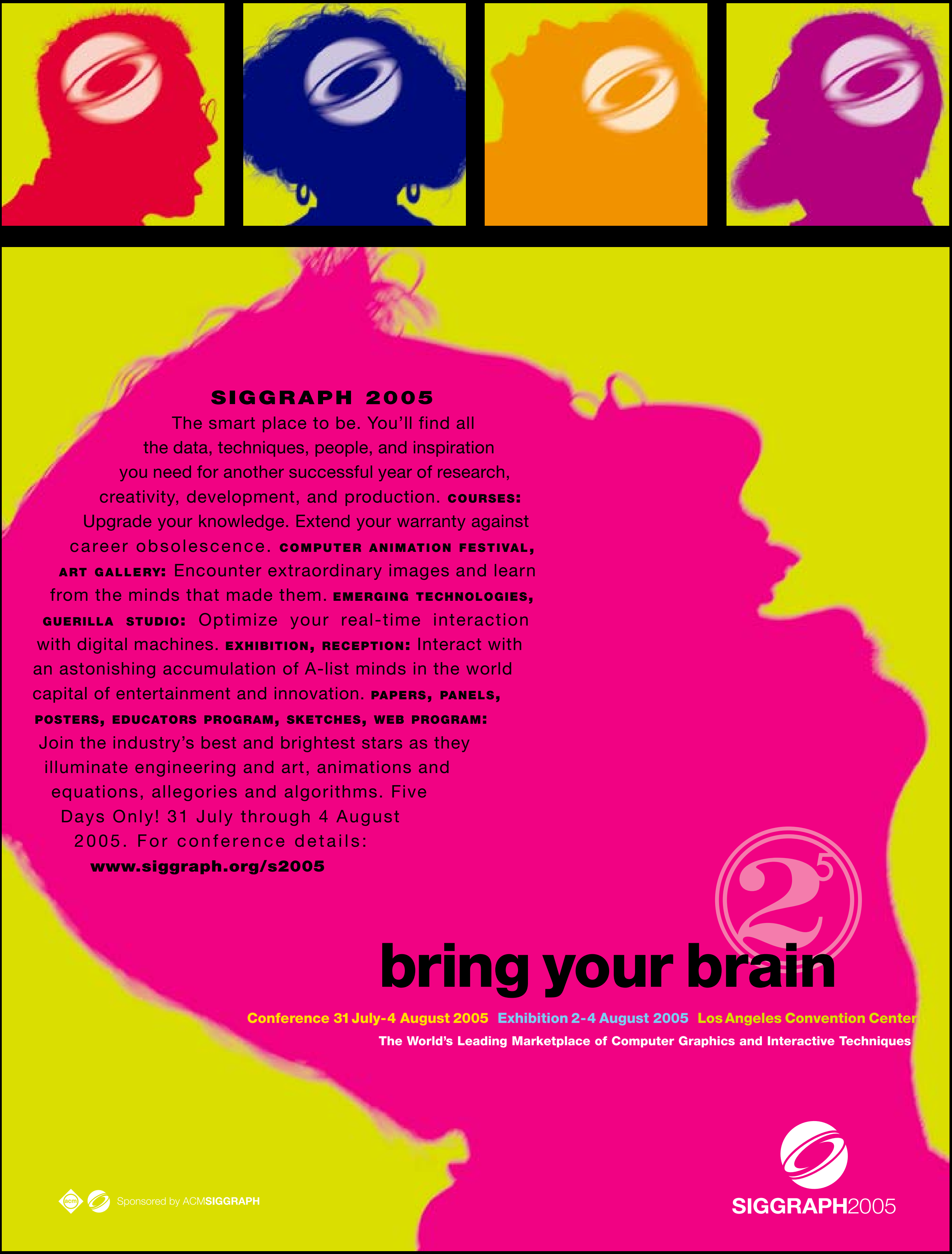
The item creation system served multiple goals. First, it increased the importance of the player's skill choices because we felt that skills were underutilized in KOTOR. The item system also improved inventory management and customization by allowing players to exchange items they weren't interested in for those that better suited their preferred style of play (demolitions experts could break down items and turn them into mines, stealth characters could break down mines and use them for stealth equipment, etc.). Upgrades were made fairly rare in the game, so the item creation system could fill its own niche without reducing the thrill of finding new items.

5 **NUMEROUS MISCELLANEOUS ENHANCEMENTS.** We expanded in small ways on many other elements of KOTOR. These improvements helped the game to feel more up-to-date despite using the same basic graphics engine and hardware as the original.

The choreographed combat, which many KOTOR players enjoyed, was expanded to include new unarmed animations. To help showcase these animations, we implemented some side quests that required them, such as duels with the Handmaidens and the Mandalorian battle circle on Dxun. We also made unarmed combat more appealing by providing Jedi with unarmed combat bonuses and having two of the player's possible companions be especially powerful when fighting unarmed.

We further enhanced the combat system and the distinction between the Jedi classes by introducing the concept of lightsaber forms, which were taken from the *Star Wars* source material. Each provides some significant benefits, but also includes weaknesses. For example, the Soresu form was best at deflecting blaster fire and was also suitable for squaring off against a single opponent. But against a lightsaber-wielding foe or many enemies, it had significant drawbacks. Force forms had a similar effect on the use of Force powers. Players can eventually learn seven of the total 11 forms, depending on their class, expanding their tactical options.

The user interface was another element we sought to improve. We added a second weapon configuration and allowed a quick shortcut to switch between the two so that players can easily change weapons from melee to ranged combat, for example. We also reorganized the inventory and equipment screens so you can sort items by type. We added additional information to many screens to reveal some modifiers and effects that were hidden in KOTOR.



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WHAT WENT WRONG

1 **QUANTITY OF CONTENT.** Given the short production period and modest staff for the project, our goals for number and size of areas, quests, and non-player characters were unrealistic, resulting in some aspects of the final product feeling unfinished. Simply put, we were too ambitious in terms of total content, and this was realized much too late. Although our content ambition was the biggest problem we encountered, the problem seems to be fairly rampant among most development studios. In fact, this specific issue has been discussed in so many *Game Developer* postmortems that we don't have much to add to what's been said in the past.

2 **CUT SCENES.** KOTOR II has dozens of cut scenes, plenty more than the first game. Many of these cut scenes, as well as numerous others that were not in the released version of the game, asked more of the game engine than it was designed to handle. In particular, any cut scene involving movement—which was most of them—suffered from unpredictable results during the making. Countless hours were spent by gameplay programmers to finalize cut scenes only to later find them broken for unknown reasons. Late in the project we observed that something apparently innocuous, such as adding an ambient sound object to a distant location on the map, could throw off a cut scene's timing. These problems added up to make an ambitious schedule even more difficult. Our programmers were often unfamiliar with the deeper nuances of the engine, so debugging and correcting these problems proved problematic.

3 **TECHNICAL LIMITATIONS.** One of the common criticisms of KOTOR II has been low frame rate. One assumption made by those who played the game was that we failed to address some of the technology limitations of KOTOR, which also suffered from choppy frame rates. These performance issues were partially the fault of design, and partially due to the time we were able to devote to optimizing the engine. While the time we were able to spend optimizing the game engine helped, we used most of those savings on making more detailed models, more non-player characters, and larger areas (to reduce the frequency of load times)—often having more than twice the active content than a comparable region in KOTOR. The load times between KOTOR and KOTOR II are comparable, although the frequency of them is much less in KOTOR II.

This approach had mixed results. Few who play the game notice the liveliness of the areas or the fact that they contained a greater variety of non-player character appearances. Had we reduced area size to KOTOR-sized levels (and thus decreased the amount of content required to make an area feel sufficiently and diversely populated), the overall game would have been more enjoyable.

4 **AI IMPLEMENTATION.** One element we wanted to improve in KOTOR II was the AI for both enemies and, especially, non-player character companions. The AI in KOTOR is quite simplistic. Companions attack their target, closing in on it if they're using a melee weapon, and attack it until one or the other is dead. They would never switch weapons. The ability to control a characters' AI was limited to specifying if grenades or Force powers should be used. How these special abilities were used was based upon simplistic algorithms, without taking into account the tactical situation.

We did not focus on improving the NPC AI until late in development, and a lack of programming resources allowed us to implement only the simplest improvements. We added a couple of behavior varieties to allow the player to control how far his companions would stray and whether they would prefer ranged or melee weapons. We had already committed to removing the companion AI interface from an obscure start menu screen and we placed it as an option on the main interface. This would have been a good improvement except that the AI options were not interesting or useful enough to warrant such prime placement.

In the end, our efforts had essentially no meaningful net impact on the game. We should have either realized that improving the AI was beyond the scope of what we could accomplish, or we should have scheduled more resources to the task so that the AI would be significantly improved.

5 **INSUFFICIENT POLISH TIME.** Many of the new game systems did not receive significant polish time. Instead of being well-refined systems, the final implementations were essentially rough drafts with design flaws that we were able to identify but not address.

Companion dialogue was implemented fairly late in the development cycle, which limited our ability to fully experiment with the influence system. The number and quantity of influence changes were not well-mapped or balanced between various characters. During late testing, we found that we simply did not have enough influence opportunities for some of the characters. With insufficient time to properly address this issue, we simply increased the magnitude of each influence shift. Fortunately, given the praise the influence system has received, this minor change adequately addressed the issue. But at its core, the influence system is not as well designed as we would have liked.

The auto-balancing system was less successful in achieving its goals. We achieved complete play-through of the game only shortly before our gold date and were unable to evaluate issues like game balance until it was too late to make many changes. As a result, we erred on the side of making the game too easy and, therefore, largely undermined the potential of auto-balancing as a tool to provide a consistently challenging experience.

Obviously, better initial design and planning would have been the best way to prevent these types of problems. But a more realistic approach might have been to schedule more polish time for properly addressing design flaws such as these.

MAY THE [ENGINE'S] FORCE BE WITH YOU

Without the high quality engine and toolset from BioWare and the extensive support from LucasArts, a game of this caliber would not have been remotely possible in little more than 14 months. We are applying the lessons learned from the goals we didn't fully attain to our future projects, including NEVERWINTER NIGHTS 2. Overall, we're pleased with KOTOR II and the feedback we've received. Given the ambitious development cycle of the project, we feel we accomplished our goal of creating a worthy sequel to the award-winning KOTOR.

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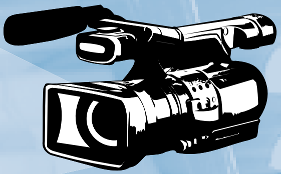

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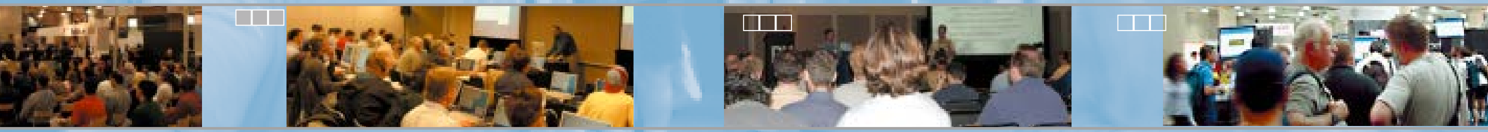

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SEAN BARRETT

OPTIMIZING PATHFINDING IV: BEATING A*

"If all you have is a hammer, everything looks like a nail."

THIS OLD SAW IS OFTEN USED TO critique software designs. Admittedly, if we're just reusing some code and it solves the problem while satisfying our space and time needs, using it would be level-headed. But if our goal is more like working a fine piece of filigree, then the saying obviously applies.

Sometimes, though, the problem is subtly screwy, and though the hammer seems to work fine, things don't square like we'd want. In this column I'm going to put A* under a loupe and throw a monkey wrench at the notion that A* is trivially the right solution for 2D pathfinding.

To be fair, I don't have an approach that's faster than A*. What I have is evidence that it's certainly possible to do better than A*; more research is required to figure out how to pull it off.

THE A* SLEDGEHAMMER

A* search is an incredibly powerful algorithm. It's often used in AI for domains where the number of reachable states grows exponentially with the number of actions. A classic toy problem that A* solves well is the sliding tile "15-puzzle." The state of a 15-puzzle can be represented by the state of each tile. With 16 possible positions, that means 16^{15}, or 2^{60} possible state values (although two tiles can't occupy the same square, so in practice it's more like 16! or about 2^{43}). A* is very effective at solving this problem, even just using a Manhattan distance metric.

But one of the key differences between typical A* applications and the 2D pathfinding domain is that our space doesn't grow exponentially. After n moves, there are at most $O(n^2)$ reachable states, not $O(2^n)$ states. One example of this difference is that iterative-deepening A* (IDA*) is frequently used in AI. Iterative deepening repeatedly searches all possible searches whose $f()$ value (the sum of the distance from the start and the A* heuristic) doesn't exceed some cutoff, increasing that cutoff each time. If the search space grows exponentially, each new iteration is so much more expensive than the previous generation that this doesn't introduce that much overhead, and it allows IDA* to avoid having to store information about all the states explored. But iterative deepening makes no sense for 2D pathfinding, where it would turn an $O(n^2)$ solver into an $O(n^3)$ one.

Another issue is the problem of large-scale barriers and dead ends, which I mentioned last month is a particular problem for A*. The 15-puzzle is more like the second map I tested for A* inadmissible heuristics, with many small obstacles, but no global barriers that would cause A* to get caught up exploring a dead-end. However, there are problems with global barriers that aren't pathfinding. Andreas Junghanns' AI research program Rolling Stone uses a very advanced implementation of IDA* to solve Sokoban puzzles (see References). Reading about how this program works offers insight into the nature and challenge of exponential search and the difference with the pathfinding domain.

For example, in pathfinding we prefer a heuristic function that can be computed very quickly, whereas in an exponential domain, heuristics that are much more computationally expensive are well worthwhile.

My intuition is that pathfinding is indeed a nail that needs a hammer, and and A* is a hammer—a sledgehammer. It's not the entirely wrong tool for the job; it just means we invest a lot of extra effort to get our nails pounded flat. And they sure are flat: A* finds the optimal solution. As I discussed last month, though, people often find A*'s performance slow enough that they undercut A*'s optimality by using an inadmissible heuristic to speed it up. This is like hollowing out the sledgehammer to make it lighter, ruining its structural integrity. Sure, it still pounds nails, but now they're all bent and beat up, and I think this hammer/nail metaphor begins to fall apart. Even so, we might be better off finding a proper hammer instead of the sledgehammer.

BETTER THAN A*

At first glance, there doesn't seem to be the possibility for a hammer, since A* is supposed to be computationally optimal. Specifically, A* explores the minimum number of nodes possible while still finding the best path, given only the information available in the heuristic. (Wikipedia.com offers a brief explanation of the theory behind this; see References.) So how can we do better? The trick here is that the heuristic actually misses out on some seemingly minor information that we often know, such as the fact that we have a grid-based map. If we unlock ourselves from the rule that the only information

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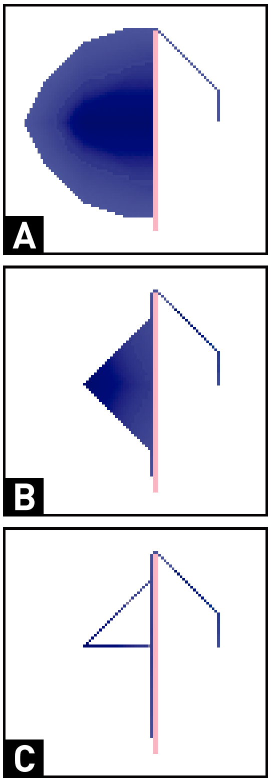

FIGURE 1 **The blue shows nodes visited by a pathfinder while finding a path from the point on the left (at the tip of the blue triangle in 1B) to the point on the right. Figure 1A shows an A* search with an octagonal distance metric. Figure 1B shows the search algorithm as described in the text. Figure 1C shows the hypothetical results for a human pathfinder.**

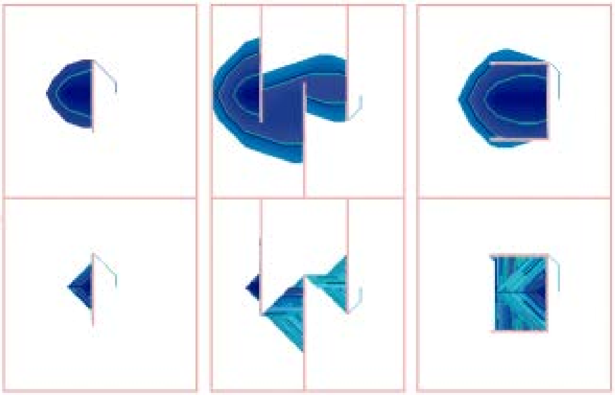

FIGURE 2 **The results for various pathfinds: A* is shown on top whereas the bottom shows "full knowledge search," which visits fewer nodes but is slower in practice.**

available to the search engine is the heuristic, we can do better.

How might we might solve the problem ourselves, as humans, if we were in the shoes of the computer program? We don't know what's on the map until we look at it, and we want to look at as few nodes as possible. It's a little like Battleship, but rather than trying to sink each other's ships, we're trying to create the shortest series of *misses* connecting two particular squares, say E2 and E9. The ships serve as obstacles to creating the paths, but until we shoot at a square, we don't know whether a ship's there or not. We want to use as few guesses as possible so that we can win (creating the best possible path before the other player does), but if we claim we've won when we haven't found the shortest path, we lose. If we don't assume anything about how many ships there are and how long they are, what's the best strategy?

Figure 1 shows the nodes explored by A* and two hypothetical algorithms when solving a simple pathfinding problem along those lines. I'd suggest that we humans would probably expect to solve the problem using a search, something like that in Figure 1C. First we scan to the right from the start point, aiming straight at the end. When we hit an obstacle, we realize that we have to go around it, and we explore both up and down looking for the shortest way around it. Once we find a "turning point" around the obstacle, we scan back to see whether we can actually get there, and then we beeline for the goal.

Although this strategy is optimal in this case, and seems intuitive, it may not be optimal in the general case. What if, when we try to beeline from the start to the turning point, there isn't a straight shot there? What if there's a complex series of barriers that we now have to get around? There might be a way around the other end of the barrier, slightly further down the first barrier but a straight shot from the start, so we'd have to balance that possibility.

That's why I think the approach shown in Figure 1B is more likely to be optimal. It follows a similar logic to Figure 1C, but as it explores along the barrier, it also constantly explores back to make sure it knows approximately how good the best path to the current point is. Although conceptually this might sound no better than A*, in practice you can see that this hypothetical algorithm still explores many fewer nodes than A* did in Figure 1A.

In fact, Figure 1B is reminiscent of the shape of the inadmissible heuristic A* searches I looked at in January's column, although here it's actually slightly better and still finds an optimal solution.

I think that part of the reason people like inadmissible heuristics for 2D pathfinding is because A* does some things obviously wrong for this domain and inadmissibility seems to fix it. The most obvious "mistake" in Figure 1A is that at some point A* started exploring nodes to the left of the start point, when it seems obvious on inspection that those points could never lead to a shorter path given what's currently known. Not until almost all other avenues are exhausted should the search need to look left of the start node.

Why does A* ever bother taking a step to the left? Because A*'s model of the world, as it infers it from the heuristic, is one of "slow teleporters."

TELEPORTERS

Let's use the term "fast teleporter" to mean a connection between two map nodes which allows a unit to move between two arbitrarily far-apart map nodes in a single rapid move—as rapid as a "non-teleporter" move. Some games with pathfinding actually have this. Laser Squad Nemesis (CoDo Games) has an alien race, the Greys, who can teleport between arbitrary pairs of teleportation devices that they place around the map. Fast teleporters make computing a good A* heuristic more difficult, since the lower-bound time between any two points depends on how close nearby teleporters are. If you have fast teleporters, implementing A* might be quite a pain.

Is there a kind of teleporter that fits well with a traditional A* heuristic? Yes, and I'll call them "slow teleporters." A slow teleporter is a connection between two arbitrarily far-apart map nodes which allows a unit to move between them using a time proportional to their distance, just as if they walked between them in a straight line—the only benefit is it ignores any intervening obstacles. In practice, few games have slow teleporters because they require a player to wait a very long time while a unit is teleporting, unable to change that unit's plan.

Here's the trick: When A* uses a heuristic that's essentially a distance metric, A* is working with a model that consists entirely of slow teleporters. If the starting map node is heuristic distance k from the goal, and the node to its left is then $k+1$, all A* knows is that there might be a route from the node to the left all the way to the end goal that takes time $k+1$. Whether that's via an intermediate path or a slow teleporter, A* has no way of knowing until it explores the node. Even if A* has already explored enough to find that the goal is surrounded by barriers and presumably unreachable, it still has no way of knowing that there isn't a direct teleporting connection from any other node on the map.

So in Figure 1A, A* explores along a set of nodes all with total cost k until it hits the barrier. It has to route around the barrier and finds that it's going to cost $k+1$. Once it exhausts other $k+1$ options, it explores the node one to the left of the start, even though it is obvious to a Battleship player that the only route from that node that could possibly cost $k+1$ goes right back through the start node, and we already know that doesn't work out.

It seems very likely to me that we can do better. In fact, I have implemented an algorithm that explores exactly the nodes shown in Figure 1B. The drawback is that in practice it's much slower than A*. The purpose of this algorithm is not to be the actual fast algorithm, but to show that it's theoretically possible to make use of a little extra information and create a search method that explores fewer nodes-the only measure by which A* is claimed to be fastest. Some other searches performed by this algorithm are shown in Figure 2.

FULL KNOWLEDGE SEARCH

The heuristic I use for my regular A* is the "octagonal" distance function $\max(dx,dy)+\min(dx,dy)/2$, which happens to exactly match the cost of movement on open areas. That suggests a different way of looking at it: The heuristic I'm using is the distance on an empty grid between the two points. I don't know what the actual contents of the grid are when computing the heuristic, but I know it's a grid.

Once I've started probing the map and collecting data about where obstacles are—once I've got a hit in Battleship—I can reconsider this. Any heuristic that relies on a path through the obstacle is clearly too low. In fact, I can simply use as my heuristic the distance from the point to the goal based on the known obstacles. Of course, computing that distance is slow, but it doesn't require me to take any shots, so for Battleship it's an effective strategy. For actual pathfinding, however, it's enormously slow.

My actual implementation simply starts with an empty map, a map in which all nodes are assumed to have the lowest costs possible. As the search explores nodes, their actual costs are copied into the "known cost" map. Each time new information is gathered, a single-source shortest-paths is run from the goal using Dijkstra's algorithm, based on the known costs, not the true map. This produces a new map of heuristic distances to the end goal, which must be a lower bound.

The main search algorithm is not strictly A*, since A* doesn't make allowances for the possibility of the heuristic changing as the search progresses. Because the heuristic can change, many nodes in the priority queue may need to be updated, not just the ones adjacent to the examined node.

Note that a single step of this search performs a full search on the "known map," so the actual performance of this search is abysmal. On the 1,024x1,024 map, it runs a million times slower than regular A*, so the fact that it searches fewer nodes doesn't mean it's faster. But even though it's important, it does reveal that simply knowing that the map is a grid provides sufficient information to visit fewer nodes than A*, so it's possible some other algorithm exists that's not insanely slow but also visits fewer nodes than A*, and might actually be faster in practice.

The question is what that algorithm might be so that it's still $O(n)$ when examining n nodes. It is not obvious to me how it could be done so efficiently, since it seems to require propagating information about the obstacles. But perhaps there's an entirely different direction from which we could approach the problem.

Of course, we can just use A*.

Unfortunately, A* just isn't fast enough on large maps, and inadmissibility isn't helpful if there are large-scale obstacles and cul-de-sacs. Hierarchical pathfinding can help, but it generally requires map pre-processing, which may limit its utility. The hypothetical algorithm described here wouldn't require pre-processing. Somebody just has to figure out if it can be realized. But not me.

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Andreas Junghanns' Sokoban solver Rolling Stone: **www.cs.ualberta.ca/~games/Sokoban/program.html**

Wikipedia A* search algorithm: **http://en.wikipedia.org/wiki/A-star_search_algorithm**

STEVE THEODORE

PIXEL PUSHER

LIGHTING DESIGN: CONTRAST

LAST MONTH WE STARTED LOOKING AT the uses and abuses of lighting for games. It's worth repeating that lighting is our most powerful tool for subtly manipulating a player's emotions. This month we're going to round off the discussion of lighting by going to the dark side, literally, by asking what is the role of contrasts in lighting design?

3, 2, 1 CONTRAST!

The last column ("Let There Be Light: Colored Light," March 2005) alluded to the way color choices in lighting can act as a kind of running commentary on the scenes and actions they illuminate. If colored lighting is all about suggestion or implication, contrast is all about bald statements and information.

Contrast, after all, is written right into the way we perceive forms. We know the difference between a sphere and a circular plate because we see gradations of shade on the curved surface. Without that contrast of highlight and shadow, color alone ends up as a set of abstractions. Color can evoke a mood, but without the definition provided by shading, it can't embody concrete things. For this reason we have a lot less freedom in how we use contrast than how we tweak color when we light scenes.

In theatrical and film lighting, contrast is expressed as the the key-fill ratio, the relative brightness of the key and fill lights. The key light represents the major source of light, such as the sun, moon, or the main room lighting. The fill light, the secondary light source, is positioned about 90 degrees away from the key light and is intended to bring the major forms of the subject into relief. High key-fill ratios produce strong contrasts, which generally suggest tension or drama. Low ratios, on the other hand, produce more even lighting and a gentler distribution of tones. The key-fill ratio is distinct from the overall brightness of the scene. High ratio scenes are typically darker overall than those with lower ratios. In traditional cinematography, contrast in lighting design has been refined to almost scientific rigor. Even though our medium is quite different, the accumulated experience of a hundred years of film and theatrical lighting is an excellent starting point when planning a lighting scheme.

The choice of key-fill ratios is usually governed by well-established conventions. TV comedies and talk shows, for example, typically use a ratio of 2:1 or 3:1. A low ratio like this produces no ominous undertones and creates even, pleasant gradations in tone. Not coincidentally, low contrast lighting also flatters the actors' complexions, de-emphasizing wrinkles and bulges. Dramatic shows, however, usually shoot at a key-fill ratio of around 4:1. This creates stronger shading, injecting some graphic tension into the composition. It also emphasizes the geometry of the actors' faces, making it easier to read their expressions. Ratios above 7:1 or 8:1 are usually reserved for thrillers and action movies. A brooding film noir shot or a stylish *Matrix* action scene might go as high as 20:1.

The conventional language of key-fill ratios is a good starting place for planning game lighting, but doesn't (and shouldn't) provide precise numbers. Real-world lighting is infinitely more subtle and complex than our crude digital approximation, where we don't have to worry about unwanted bounce light or shadows, and we can choose whether to let our lights fall off with distance. But even if you can't rely on the numbers, you do need to be aware of how those conventions will shape the audience's reactions. You can violate those expectations, but it's not wise to do so without a clear reason in mind.

LIGHT DEFINES SPACE

The list of key-fill ratios doesn't cover all possible lighting scenarios. The canon of cinematic lighting focuses on modulating the appearance of the actors, but a great deal of game lighting is really about defining spaces rather than spotlighting characters. Oddly shaped or unusually constructed spaces need to be lit with particular care. Lacking some of cinema's built-in cues, like atmospheric effects, depth of field, and shape-emphasizing radiosity, it can be hard for players to decipher an unfamiliar setting. It's usually wisest to begin experimenting with a moderate contrast ratio, in the region of 3:1. Go much lower than that and it becomes difficult to perceive the 3D contours of a space (although cartoonish environments with very strong color contrasts are an exception). On the other hand, very high contrast ratios tend to disassemble the scene altogether, reducing it to an abstract pattern of light and darkness in the classic film noir style.

SUNNY SIDE UP

When you have complete control of the scene, especially in enclosed spaces with artificial light, you can base your contrast scheme on the dramatic needs of the game, using the contrast to create or diffuse graphic tension. Lighting for outdoor scenes, however, is a much trickier business.

Most developers know that the 24-bit color space used in games is so fine that most people can't actually see all

Key-fill contrasts

TV news	1.5:1
Sitcom	2:1
Drama	4:1
Action sequence	8:1
Horror movie:	10:1
Film Noir	16:1

STEVE THEODORE *started animating on a text-only mainframe renderer and then moved on to work on games such as* Half-Life *and* Counter-Strike*. He can be reached at* **stheodore@gdmag.com**.

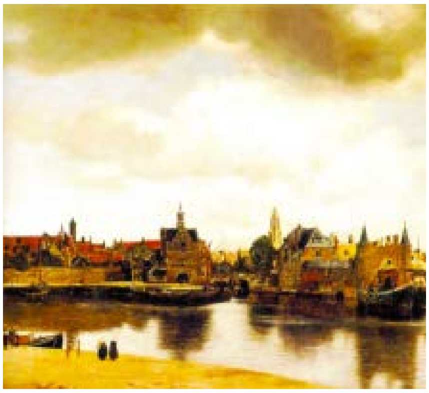


FIGURE 1 Johannes Vermeer's *View of Delft* (1660).

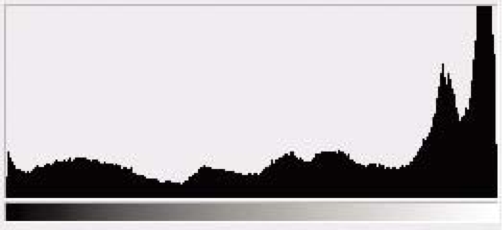


FIGURE 3 This histogram shows the distribution of light and dark colors in Figure 1.

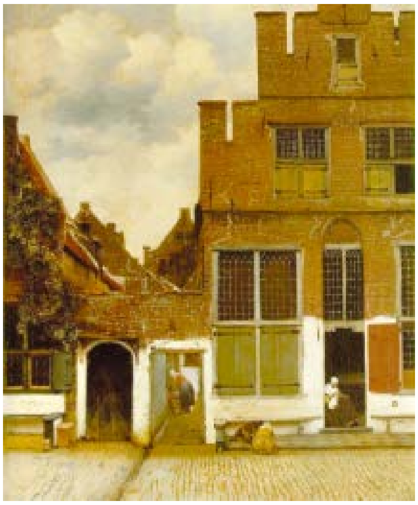


FIGURE 2 Johannes Vermeer's *The Little Street* (1657).

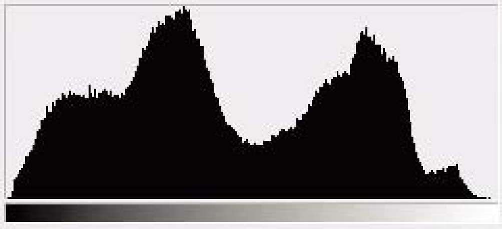


FIGURE 4 This histogram shows how mid-tones predominate in Figure 2.

16.7 million possible RGB colors distinctly. That's true, but it's only part of the story. We all know that an RGB value of 255, 255, 255 means white. But the white of a piece of paper and the white of a snowy field are hardly the same. From the standpoint of pure physics, snow on a sunny day may reflect 300 or 400 times more light than that sheet of paper. Of course, we know our monitors and TV screens aren't as bright as a kid's flashlight, much less the sun (not a bad thing, when you recall our unhealthy addiction to garish sprite effects). How can we recycle those measly 256 levels of brightness to represent everything from the mines of Moria to the blazing nebulas of distant galaxies?

DOTH MY EYES DECEIVE ME?

Luckily for us, our pictures (and photographs and movies) work within such a limited range because our eyes are programmed to recalibrate their perceptions of light and dark. Mid-tone shadings that would be easily distinguishable under a reading lamp are blanked out in the bright light of day. Faint glimmers of light that would be invisible in daylight are easy to navigate by at night. Most of us are capable of distinguishing between 100 and 200 shades between black and white. As white grows or shrinks in intensity, our brains basically stretch those hundred or so shades to cover the whole range from darkness to lightness. Since our eyes are already doing a great deal to compress the huge range of intensity variations, we're physiologically primed to accept monitor images or printed pictures as "real" even when they cluster in a very narrow range of absolute intensities.

This might seem like just interesting trivia, but in fact it's critical for effective contrast management. Our ability to recalibrate teaches us that the distribution of contrast in the image is an indication of the strength of the light source(s). This is actually something of a paradox. Bathing a scene with intense light ought to mean that every surface is reflecting more back to the eye, and so you might expect the image to wash out. Our biological contrast filter, though, has to stretch our limited visual palette to cover the intense highlights as well as the somewhat elevated ambient colors. Even though the low tones really are brighter in absolute terms, that increase is insignificant against the vastly expanded scale of intensities. Tones in the low end of the scale will seem darker even as they reflect more. For obvious reasons, therefore, we instinctively see contrast as a proxy for the intensity of light in a scene. Sharp contrasts suggest intense light sources while an even distribution of mid-tones implies a softer light.

For a perfect example of this principle, take a look at the two Vermeer paintings in Figures 1 and 2. The sharp contrast between the glaring sky and darkened houses in Figure 1 subliminally reminds us that the sky should really be hundreds of times brighter than the bricks and stones. Conversely, the very level tonal range of Figure 2 recalls the dim, ambient light of an overcast day; the contrasts are so gentle that the whitewashed walls seem dingy, even though they are almost exactly the same luminosity value as the bright sky in the first picture. As you can see from the histograms (Figures 3 and 4), the "brighter" image actually uses far more dark colors.

The complex role of contrast is both a blessing and a curse for artists. As the two paintings demonstrate, it's possible to suggest enormous variations in light conditions convincingly simply by manipulating our expectations about contrast and intensity. At the same time, our tendency to read contrast as an indication of intensity places some limitations on how much we can tweak it in game scenes. This, in turn, can create some tricky problems when the needs of composition and mood conflict with the demands of realism. When designing lighting for an indoor scene, you can cheat your way to whatever contrast scheme suits your needs. If you invoke natural light, however, you give up a good deal of freedom—unless, of course, you're content with the perpetual dreary overcast that passes for outdoor lighting in most games.

TAKE IT OUTSIDE

The variable intensity of outdoor lighting also places a large strain on texture artists. Imagine the following scenario: You ask a texture artist for a brick texture. Naturally, you want it to contain all sorts of subtle little details, cracks, stains, and so on. In order to include those, the texture artist uses most of the RGB range in painting the texture; the cracks are down near black, the mortar up near white and so on. You look at the texture in isolation, it's great. You render the texture in the game on a moderately lit interior wall and again, it looks great. Then you try it outdoors and run into an obvious problem: The white in that mortar is as white as the clouds in your skybox, which should be several dozen times brighter (see Figure 5).

There's no easy way to preserve both the detail in the original texture and the lighting of the scene. You could make two copies of the texture and dim the exterior version. Doing so costs memory and throws away some of the detail data in the dimmed version but retains the subliminal sense of natural light. If texture memory is at a premium, though, you may have to reuse the original version of the texture, accepting that the even contrast in the final image will destroy the illusion of outdoor lighting. Many offline renderers (and a scant handful of game engines) will allow you to apply a post-process darkening to the texture (or, if you're particularly lucky a post-render gamma correction) that mimics the adaptive behavior of the eye. With most contemporary real-time engines, you'll have to sacrifice something, either memory or lighting fidelity. A useful trick, if you have support from your coders, is to add a dimming coefficient to the material system; you can tune down the original texture without having to duplicate it. Nevertheless, the basic problem remains: While you can let your imagination run wild in indoor scenes, naturalistic, outdoor lighting is a very demanding medium.

LIGHTEN THE MOOD

Hopefully, up-and-coming technologies will at least lighten the burden of coping with naturalistic lighting. Few of us can match Vermeer's eye for the subtleties of light—but even fewer of us have game engines that can handle dynamic over-brightening very well, much less true HDR rendering. Progress is being made, though. Some remarkable work is being done in academia, and in offline rendering (notably last year's *Spider-Man 2* and *The Matrix Reloaded*). In the meantime, Masaki Kawase's image-based lighting demo (www.daionet.gr.jp/ffmasa/rthdribl) shows how much can be achieved in real time today, albeit under tightly controlled circumstances. For most of us, though, it will be quite some time before we can rely on technology to simulate the real behavior of light. While difficult, immersive lighting is far from impossible. ICO proved that even a PS2 can marshal the intricacies of light in the service of storytelling. The point, after all, isn't to create a soulless simulation of photons bouncing around, it's to set a mood, create an atmosphere, and to transport players into the worlds we build for them. ⁙

RESOURCES

Paul Debevec's web page is a good starting place if you're interested in learning about High Dynamic Range images.
www.debevec.org

HDRShop is a paint program for dealing with images that reflect large variations in light intensity.
www.hdrshop.com

Watercolorist Bruce McEvoy is assembling an excellent, if rather technical, web site on the perception of light and color.
www.handprint.com/HP/WCL/wcolor.html

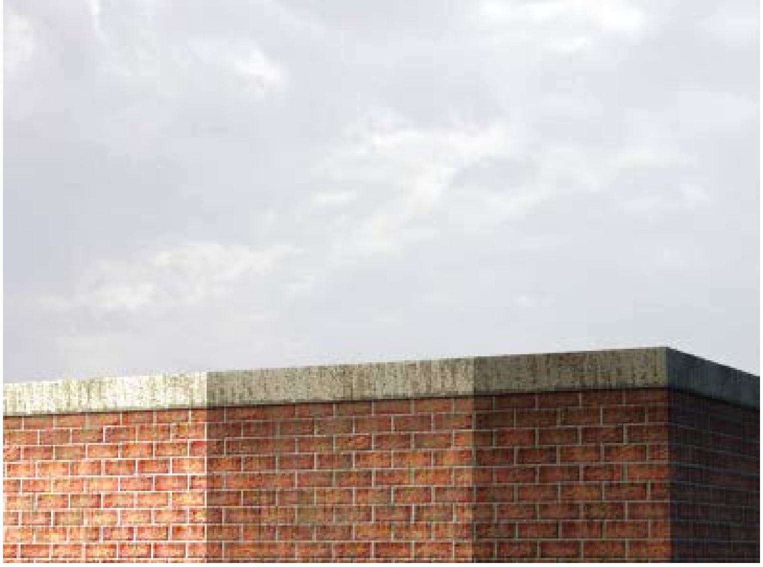
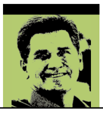


FIGURE 5 With this dynamic range expansion at work, note how the contrast between the brick texture and the sky changes the apparent weather and time of day in the sky box.



DAN LEE ROGERS

NECESSARY EVIL

THE TERMINATOR

IN THE SCI-FI THRILLER *THE TERMINATOR*, Arnold Schwarzenegger plays a ruthless robot sent back in time to assassinate man's only hope for the future, a woman named Sarah Connor. At one point, fellow time traveler Kyle Reese tries to make Sarah understand the extent of the danger she faces.

"Listen. And understand," he pleads with her. "That Terminator is out there. It can't be bargained with, it can't be reasoned with…"

Likewise, game developers should heed the same advice when it comes to the termination clause in their publishing contracts. Like the Terminator, it doesn't feel pity, remorse, or fear. And once you agree to it, chances are it won't leave you alone until you are dead!

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HASTA LA VISTA, BABY

Developers are generally reluctant to think about the possibility of having their games canceled. But for publishers, termination is used regularly as a means to manage product portfolios, and it's this difference that gets developers in the most trouble. They need to remember that in today's business environment, where retail shelf space is at a premium, publishers are more apt to terminate a game before it's completed, especially when its financial success is in question. Like a marriage prenuptial agreement, those who contemplate the unthinkable in advance are better prepared if the unimaginable occurs.

COME WITH ME IF YOU WANT TO LIVE

In a contractual agreement there are two termination scenarios that a developer must consider: termination for breach and for convenience.

From the publisher's perspective, termination for breach means the developer has utterly failed to meet its promises, leaving the publisher no other choice but to litigate. Fortunately, this rarely happens. Publishers enter development agreements in good faith, hoping for a killer game and a lot of money. They seldom exercise termination for breach because it means dire consequences for all. It's expensive, it solves very little in the short run, and it fails to give a publisher what it needs most: a profitable game.

Termination for convenience, on the other hand, is an escape-hatch that's frequently used, and one that can wreak havoc on an unwary developer.

Most contracts allow a publisher to cancel a project in whole or in part at any time during the development process. This exit strategy is necessary, but the "in part" portion can be especially damaging to their development partner. When negotiating a contract, to mitigate their risks, a publisher will often shift a significant percentage of the development costs to the end of the project. From their viewpoint, this gives the developer an incentive to deliver a game on time and on budget.

Unfortunately, if both parties aren't careful, a significant percentage of the developer's profit can be erroneously reallocated to these final milestone payments. If the contract is terminated prematurely, through no fault of its own, a developer can lose a disproportionate amount of its pre-royalty margin. As an example, the delivery of language conversions and additional game platforms are often weighted much heavier than the actual man-power necessary to complete them. As a result, the cancellation of either one can easily vaporize the developer's planned pre-royalty profit.

I'LL BE BACK

When invoking their right to terminate for convenience, most publishers are willing to provide a developer with some financial severance, most often in the form of a payment for work-in-progress and, less frequently today, payment for a mutually agreed-upon number of future milestones. But what both parties need to consider is that this scheme oversimplifies the actual costs that a developer incurs. In some cases, the developer is rewarded for a project being canceled, but in most instances they are penalized, because their true costs not only include the labor and other costs apportioned to the cancelled game, but also the costs of transitioning their team to the next project.

Should a publisher even be expected to pay a developer's transition costs? After all, one of the primary reasons a publisher uses an independent developer is to eliminate the expense of a full-time, in-house team. Besides, a developer is expected to run its business in a manner that provides it with the capital necessary to pay for this unanticipated down-time, right?

THE FUTURE IS IN YOUR HANDS

As we move into the next generation of console games, the stakes will be higher than ever. Developers and publishers alike need to be willing to openly discuss the actual costs of transitioning a team for the convenience of the publisher. Fortunately, this is rarely a problem when dealt with in advance. The difficulty arises when the developer is inadequately prepared to discuss its burn rate and profit expectations, and when the publisher is inclined to simplify what can be a complex problem for its partner.

Both parties owe it to the other to carefully consider the reality of termination for convenience. After all, once the contract is signed, it's nearly impossible to send someone back in time to change the future. ⁙

DAN LEE ROGERS *is president of BizDev Inc., a leading business management firm specializing in the video game market. You can reach him at* **drogers@gdmag.com.**

ZAK BELICA

AURAL FIXATION

SOUND PRINCIPLES: VOICE DIRECTION

I RECENTLY HAD THE OPPORTUNITY TO serve as voice director for the Legacy Interactive project ER: Critical Condition, based on the TV show *ER*. We were able to get the television show's leads Noah Wyle, Sherry Stringfield, and Mekhi Phifer, in additional to several supporting actors, including Abraham Benrubi and Yvette Freeman. It's a big plus to have great established talent to work with on a game project, as they know their characters very well and are used to taking direction. However, talent alone does not a great session make. Preparing well in advance, having project context, and building a positive director-actor relationship are some of the things you can do to make your job as voice director run smoothly.

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***ER* star and Critical Condition voice actor Noah Wyle's in-game avatar.**

PRE-PREPRODUCTION

I always find that personally going through a rough read of the entire script is invaluable. This allows you to identify which lines do and don't work, and provides a rough assessment of how the script works in-game. Using this method makes the real voice-over session the second iteration of the script read and results in a more refined product.

Always arrive at the studio early to build a relationship with your engineers. The technical aspects are in their hands, so it's best to communicate what you expect in both audio quality and asset organization. Scripts should be printed, collated, and organized for the session, with enough copies for everyone there plus one extra. If you're fortunate enough to be recording at a location that has an automated script/take management system, you'll be in even better shape because the engineer will be able to auto-label your takes.

At a minimum, a voice director and game producer should attend the session. If you can include a game designer, even better. For ER: Critical Condition, we had producer Mike Donges on hand with level designer Greg Faccone giving support.

And though you want a few key people to attend a voice-over session, try to keep extra bodies to a minimum, as additional commotion can be distracting for both you and the talent.

ONLY ONE CAPTAIN

The voice director needs to be the ultimate authority in a session. There are times when everyone in the room will be looking to you for guidance, and you need to be decisive. You're the captain in this situation, so be sure to have a clear idea of what you expect from the performances going into the session. Also, let others attending the session know that you're the director and that they should implicitly follow your lead. However, don't consider this to be a license to be a tyrant; the situation is best served by considering the needs of the team.

However, you need support to succeed, so consider the input of the game producer and level designer during the session if they feel certain lines need a different direction.

DIAL THE TALENT IN

I find the best way to make a connection with the voice talent is to get to know them a bit first, make a few jokes, and give them a concise description of the project and the part they're performing. In my experience, Hollywood actors have generally all done automated or automatic dialogue replacement, but may not have game audio experience. In these cases, I try to give a little more context to the script than I usually do. On ER: Critical Condition, I had Greg Faccone brief the talent on what was happening in each episode. After that, a synopsis before each line can be given as needed.

ACTORS AND GAMING

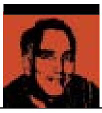
Even though the actors we used for ER were all very talented, some had never done a game voice-over session before. Gaming sessions can be disorienting for an actor because there's a lack of visual and physical context for them to perform to. As a result, you must paint a picture of the game situations for the actors as the session progresses. On the plus side, I've found that many actors play games themselves, so it's easy to tune into the project.

For the ER sessions, it turned out that Phifer joined into occasional Halo frag-fests on-set, and Benrubi was a City of Heroes player and experienced gamer. Their gaming experience made the adjustment to gaming voice-overs easier.

DON'T FEAR THE CUT

While big name actors are a good resource, there are times when game-centric voice talent can give a project exactly what it needs. However, when you're casting parts, you have to take a small risk that the actor you choose may not be able to deliver the performance you need. While we did not have that problem with ER, there are times when the actor you chose for the part simply isn't working out. It may be a characterization problem or a lack of connection to the material. You are the first line of quality control, so don't be afraid to switch the actor to another part you think may work better, or at worst, thank the actor for their time and call it done. You'll save yourself the pain of trying to get what isn't there, and the day's sessions will go much smoother for it. ⁙

ZAK BELICA, *a guest columnist, is a composer and sound designer with seven years of experience in the game industry. He currently serves as audio director for Ritual Entertainment. You can reach him at* **zbelica@gdmag.com**.



NOAH FALSTEIN

GAME SHUI

SLEEPING DOGS DO IT

THERE'S A RULE THAT ALL EXPERIENCED game designers know, yet still gets surprisingly little press.

THE RULE

Lie about how great your design is.

THE RULE'S DOMAIN

This rule applies to all game designers and pretty much everyone the designer interacts with. Lie to your producer. Lie to your developers. Lie to your CEO. Above all, be sure to lie to your publisher. You will often even find it advisable to lie to yourself, but first consult the trumping information.

IT TRUMPS

"Honesty is the best policy," a rule that must have been set up by someone wanting to improve his chances of getting rich quick through pyramid schemes. Haven't heard about pyramid schemes? That's a tough one to explain, but send me $10 and once I get enough responses to cover my expenses, I'll send you a description, and you can get rich selling it to other people. Better make that $20. Monthly.

Besides, truth carries a heavy price. Instead of saying, "My game will be incredibly great and is sure to sell 18 million units," you could say, "I think I've designed a great game, but the development staff could fall short of the vision, or the producer could step in and screw it up, or another company could come out with something better in the same genre two months earlier, or I could just be plain wrong." You would be praised for honesty first, and later, you'd be demoted.

IT IS TRUMPED BY

"You should tell the truth to your marketing department." It's their job to lie, so if you do it for them, it could result in double-negatives that inadvertently tell the truth about your game. You may also tell the truth to game testers if you prefer, since (a) they already know how bad your game is, (b) they're testers, so if they rat you out no one will pay attention to them, and (c) they already are sure they are better designers than you so they won't believe your lies in the first place.

Lying to yourself is also helpful. After all, if you don't have the ego to believe your design will be incredibly great when everyone around you has doubts, how will you persuade them to create a new, ground-breaking masterpiece? However, you may wish to curtail lying to yourself if you find that people close to you are starting to mutter, "Pathological"—people like your mom, or your spouse ... pardon me, ex-spouse.

EXAMPLES AND COUNTEREXAMPLES

There are myriad reasons to use this rule, but I'll try to hit on a few of the most critical. First, you have to lie about how great your concept is or there's no chance it will be green-lighted in the first place. Another designer in your company *will* lie, and the director in charge of green-lighting games will go with that design instead because it sounds so much better. Sure, that director should theoretically be experienced enough to spot an exaggeration or an impossible claim—*if* he told the truth to get his job.

Then, you have to lie to your producer about how great the game will be so he can in turn lie convincingly to his boss, preserving funding for the game. You have to lie to the press because they've all become so cynical that if you tell the truth they'll become suspicious and assume you're up to something. You have to lie to your marketing department because they're not smart enough to come up with their own lies about the game without making it sound worse than it really is. I know, I said earlier you should tell them the truth, but I was lying.

IMAGE COURTESY OF FREEFOTO

If for some odd reason you don't want to take my word on this, consider these pearls of wisdom:

"Truth titillates the imagination far less than fiction."

—*Marquis de Sade*

"The reason we hold truth in such respect is that we have so little opportunity to get familiar with it."

—*Mark Twain*

"Let us begin by committing ourselves to the truth—to see it like it is, and tell it like it is—to find the truth, to speak the truth, and to live the truth."

—*Richard Nixon*

CAVEATS

If any of my clients or co-workers read this, of course I wouldn't lie to you. You're too smart and perceptive for me to get away with it.

This column may have been written specifically for the April 1, 2005 issue of *Game Developer*. Or, I might be lying about that. But it's a truly great column. Trust me.

NOAH FALSTEIN *is a 25-year veteran of the game industry. His web site,* ***www.theinspiracy.com****, has a description of The 400 Project, the basis for these columns. Also at that site is a list of the game design rules collected so far and tips on how to use them. Email him at* ***nfalstein@gdmag.com****.*

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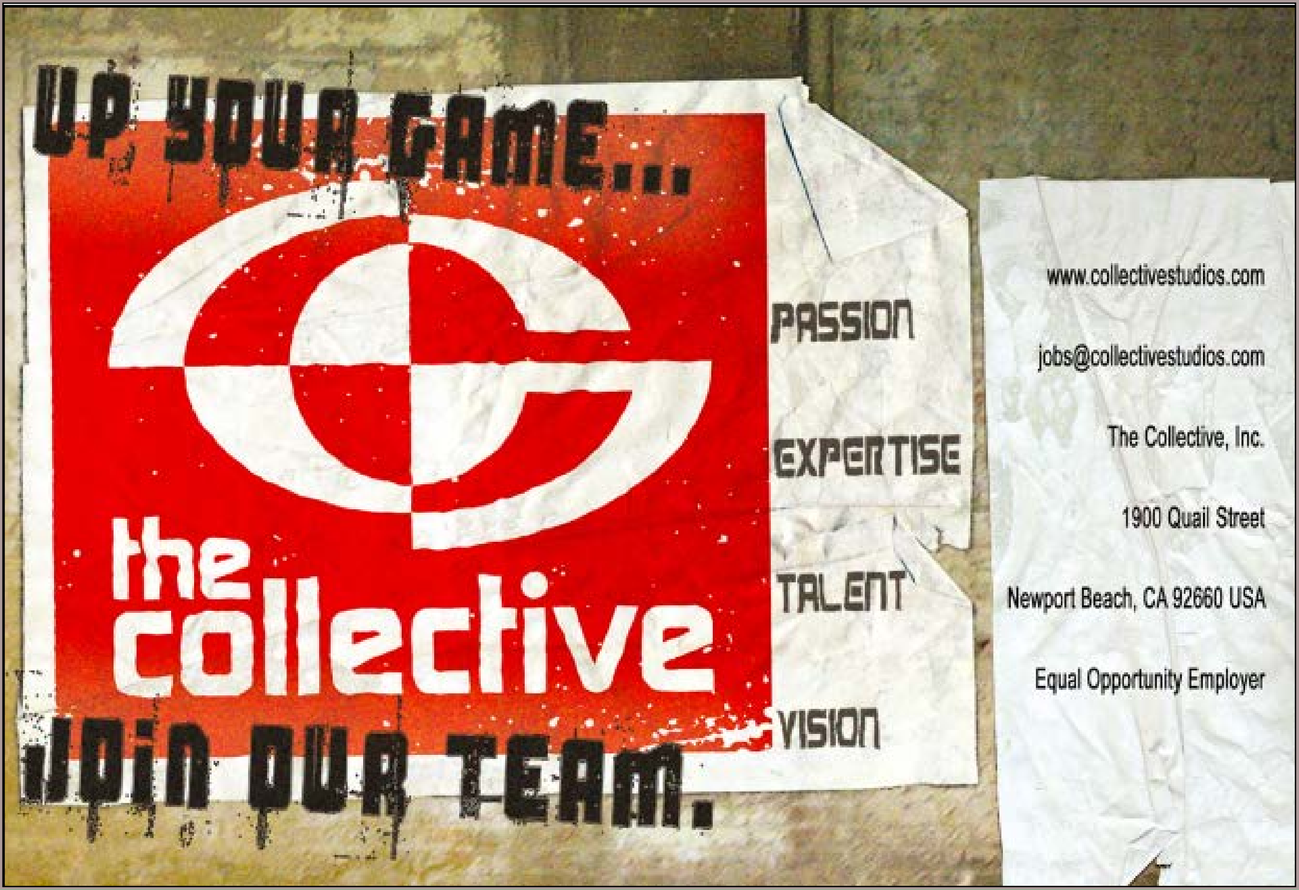
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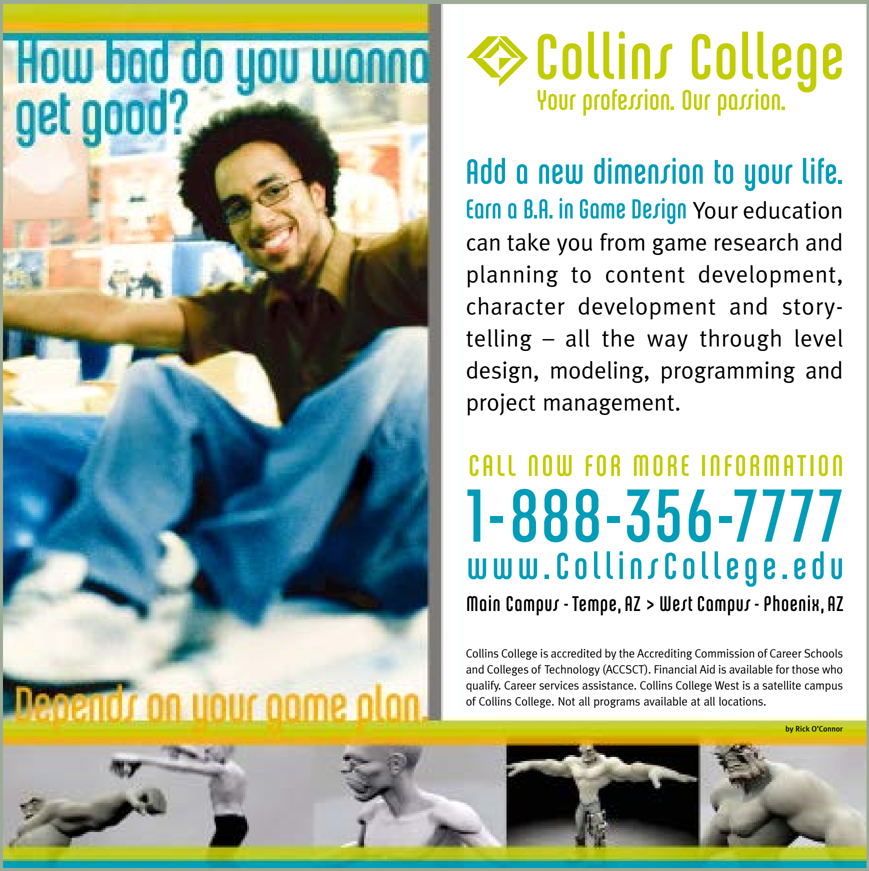

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by Rick O'Connor

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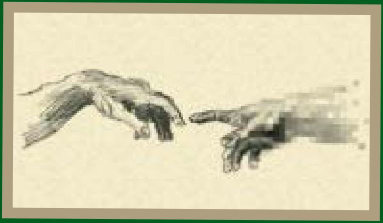

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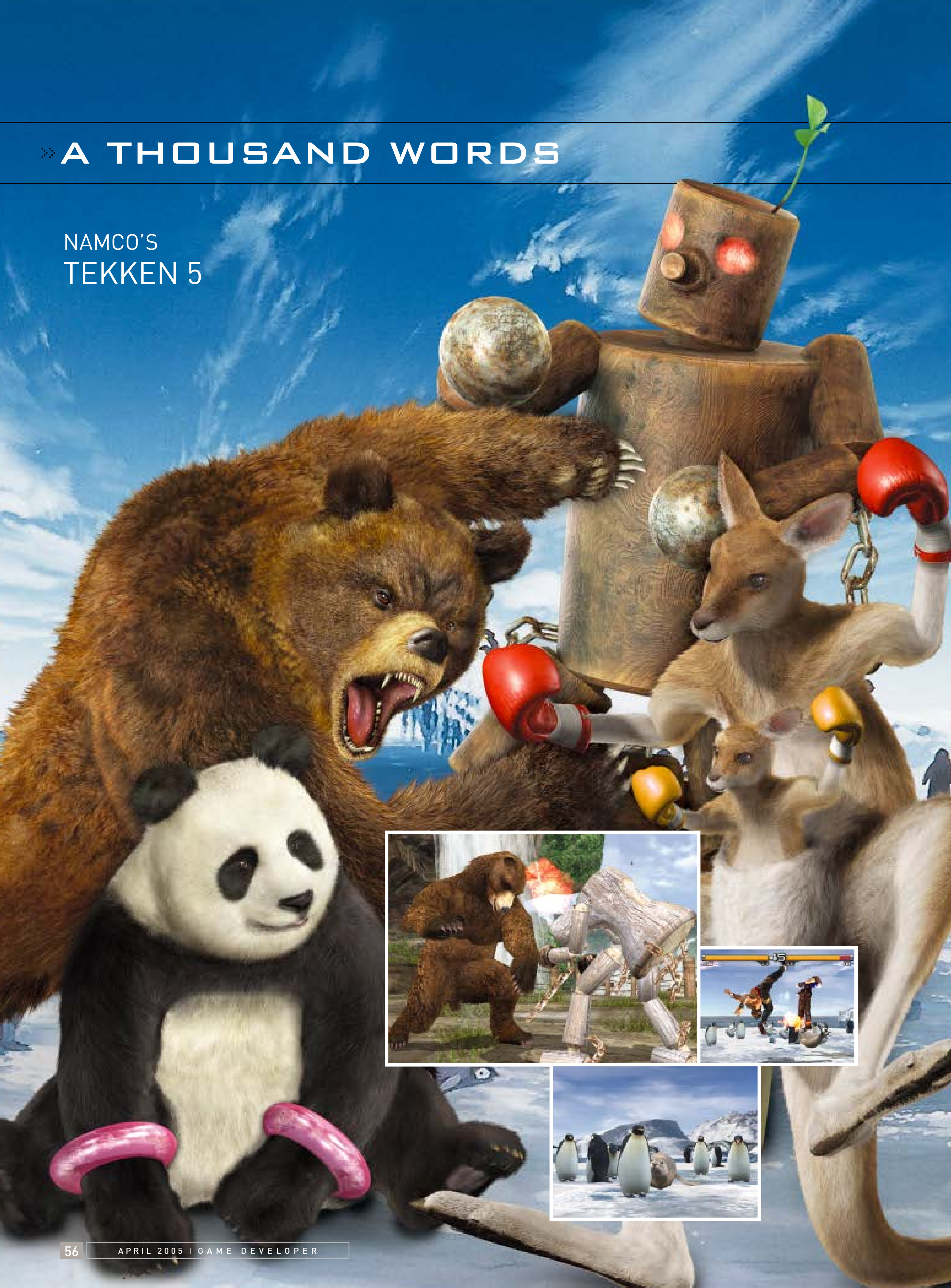

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