

MARCH 2006

game developer

THE LEADING GAME INDUSTRY MAGAZINE

» WATCHING THE SKIES

BUILDING DYNAMIC
HEAVENLY BODIES

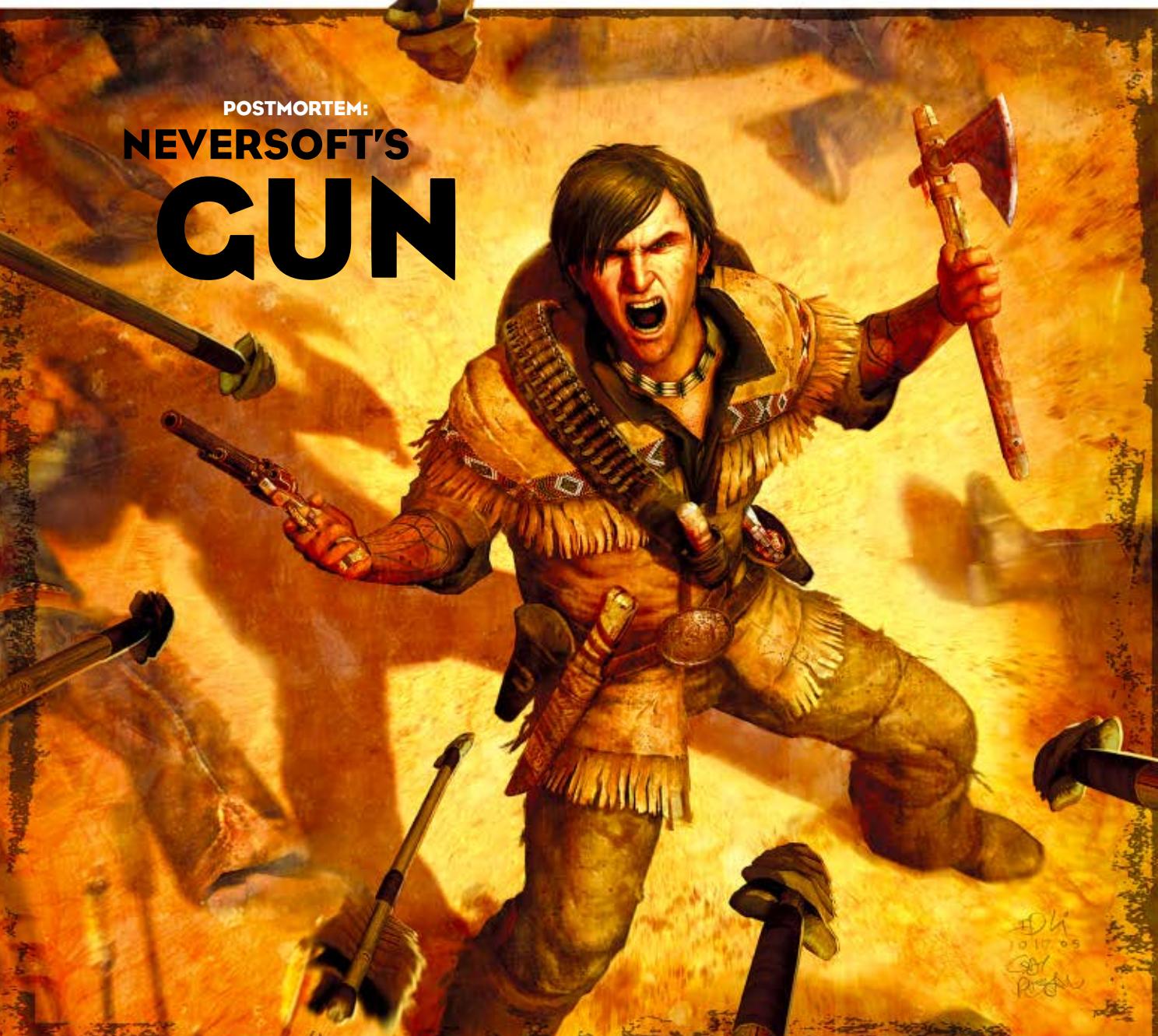
» PLAYING CATCH-UP

VINTAGE GAME CREATORS
ON AGING GRACELESSLY

» BUSINESS LEVEL

FROM NINE TO FIVE
WITHOUT THE SLACK

POSTMORTEM:
**NEVERSOFT'S
GUN**



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POSTMORTEM

34 GUN: THE GOOD, THE BAD, AND THE UGLY

It's no simple task to create an original IP from scratch, let alone to release it for multiple consoles, including the next-gen Xbox 360. This was Neversoft's task with GUN, and a particular challenge given the company's long ties to licensed titles. Can veteran cowboys learn new tricks, or will they fall into the same old gulch? This postmortem offers a very honest appraisal.

By Scott Pease and Chad Finley

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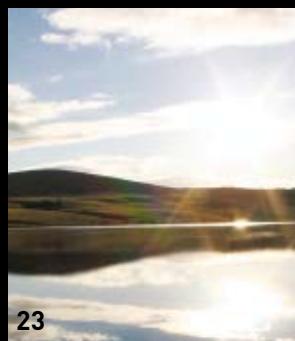
With GDC just around the bend, the editors of *Game Developer* and Gamasutra.com have written up a set of event highlights, session previews, and other informational delights. While by no means a comprehensive guide, this feature gives you a nice sampling of what's to come, filtered by the personal preferences of each editor.



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23 DYNAMIC SKYSCAPES

A game's sky is integral to its believability, but creating a convincing one can sometimes be a daunting task, especially in the new generation of consoles. In this technical artist's article, Michael Gehling details the creation of a stunning yet scalable sky using modern techniques. This should take some of the strain off both coders and artists alike, without compromising quality.



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By Michael Gehling

44 PLAYING CATCH-UP

In this series of interviews, important figures from the golden age of game development, including Al Lowe, Steve Purcell, and David Crane, clue us in on what they've been up to over the years, and what they're up to now. The article begs the question: Where will you be in 20 years?



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OUTLAWS OF GAME

THIS MONTH'S BUMPER ISSUE MANAGES TO COVER a plethora of bases, but the one that's most likely to jump out at you is the lone gunslinger from Neversoft's GUN, making a last stand on the cover and appearing in a postmortem on page 34.

Originating, as it does, from the developers of the classy TONY HAWK'S PRO SKATER series and SPIDER-MAN, and blessed with a mysterious monolith advertising it at the 2005 E3, GUN was one of the products we were most looking forward to for this past holiday season—not least because it was one of the few major new original IP titles released in time for Christmas. And, heck, it's that relatively rare thing, a Wild West game.

However, GUN, while scoring a solid 80-ish percent average across game review web sites, clearly wasn't received rapturously by the gaming press, who particularly dinged it for being a briefer experience than they would like. But, in common with PSYCHONAUTS and a few other games of the past couple years, the title is a completely game developer-generated original world that feels like a living, breathing mythos. The careful, detail-oriented approach of the developer makes a postmortem particularly worthwhile in understanding the game's lofty aspirations and rough and tumble attitude. Our thanks go to Neversoft for being honest enough to tell us about it.

GDC GLEE

We're not covering the 2006 Game Developers Conference in our editor's preview (pg. 11) because our colleagues elsewhere in the CMP Game Group produce it—rather, we do it because there's so much neat content this year, and we're as eager to get to the best lectures, roundtables, and tutorials as you all are.

In any case, the preview includes basic info on some of the major sub-conferences and special events taking place in San Jose this March, as well as five specific picks from each editor [with a special cameo from the Gamasutra editors] on some of our favorite putative sessions, from discussions of prototyping in SPORE to Namco's Japanese arcade conversion of COUNTER-STRIKE, and beyond.

WHAT WERE THE SKIES LIKE?

Whether they go on forever and ever or not, many games need some kind of way for the player to look up and not be horrified by a badly texture-matched skymap. In this month's technical article (pg. 23), Michael Gehling walks us through the building of an

entire skyscape from scratch, complete with stars, a sun, and a moon, through the much more complex clouds, suggesting some possible approaches for each, and including plenty of visual examples.

DO NOT GO GENTLE

The "Playing Catch-Up" series is a set of interviews with classic game developers that appeared on our sister web site Gamasutra.com late last year. We've picked some of our favorite pieces, including chats with LEISURE SUIT LARRY creator Al Lowe, PITFALL designer David Crane, and SAM & MAX's daddy Steve Purcell, presenting some fun reminiscences about the old days (pg. 44).

For those of you who aren't yet reminiscing about the good old days, you're probably familiar with the more recent and ongoing debate about work practices and office culture. An extremely provocative Business Level column by David Amor from U.K. developer Relentless Software discusses why a much stricter approach to employee practices, such as curbing internet use and mandating nine to five hours, can actually create a much more efficient, contented work environment, contrary to what some might presume (pg. 49).

XBOX LIVE ARCADED

Finally, just a word regarding the halcyon Xbox 360 Live Arcade experience. As a gamer who doesn't always have time to play through the 80-hour epics [editing magazines takes a little time], and with a healthy retro arcade leaning to start with, I was predisposed to love Xbox Live Arcade. But its bite-sized chunks of casual goodness in games such as GEOMETRY WARS EVOLVED, MARBLE BLAST ULTRA, and OUTPOST KALOKI X are making me love simple games all over again. It's very obvious that at least this part of Microsoft's strategy is a home run.

The only question I have is this: Seriously, will Live Arcade stop people from wanting to buy as many full-price \$60 games for next-generation consoles? I already feel marginally less motivated to do so, but then again, I apparently bought a \$400 console largely to play 1980s style arcade titles. I'm probably the odd man out here.

My hunch is that there's room in the market for both the big and little guys, even if it does mean that the money diffuses out a little more than some may be expecting. ☺

S!

Simon Carless, editor-in-chief

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GOT NEWS? SEND US THE BIG SCOOP AT EDITORS@GDMAG.COM

NPD Shows 2005 PC Gaming Drop

Top 10 selling PC titles by unit sales in the North American PC game retail market, 2005

RANK	TITLE	PUBLISHER	AVERAGE RETAIL PRICE
1	WORLD OF WARCRAFT	Vivendi Universal	\$47
2	THE SIMS 2: UNIVERSITY EXPANSION PACK	Electronic Arts	\$33
3	THE SIMS 2	Electronic Arts	\$45
4	GUILD WARS	NCSoft	\$48
5	ROLLER COASTER TYCOON 3	Atari	\$30
6	BATTLEFIELD 2	Electronic Arts	\$48
7	THE SIMS 2: NIGHTLIFE EXPANSION PACK	Electronic Arts	\$32
8	AGE OF EMPIRES III	Microsoft	\$47
9	THE SIMS DELUXE	Electronic Arts	\$19
10	CALL OF DUTY 2	Activision	\$46

SOURCE: NPD GROUP

U.S. VIDEO GAME SALES CHART

compiler NPD Group has announced disappointing news that U.S. retail sales of PC game software reached only \$953 million in 2005, a 14 percent decrease compared to the \$1.1 billion generated one year earlier.

According to NPD, PC game unit sales were down 19 percent for the year, totaling 38 million units versus 47 million units sold in 2004. However, this figure did not take into account digital downloads of casual, MMO, or other titles, a rapidly increasing area of the PC market.

Overall, the year's top selling game for PC was, unsurprisingly, Blizzard and Vivendi's colossal MMO hit *WORLD OF WARCRAFT*, which recently claimed 5 million worldwide subscribers, though not all of these were in the North American territory.

Also moving many units despite the

down curve was EA's *THE SIMS 2* and its two associated expansions. *THE SIMS* franchise collectively took up four of the top 10 spots on the year-end chart for best selling PC games.

The remainder of the top 10 includes several mass-market accessible games, such as *ROLLER COASTER TYCOON 3*, alongside a number of MMOGs and hardcore shooters such as *GUILD WARS* and *BATTLEFIELD 2*.

As a result of this skewing away from retail, NPD will be changing its PC chart calculation in the near future. According to NPD industry analyst Anita Frazier, "NPD will be launching its new definition of the U.S. PC game market this spring which will include a combination of sales from retail, downloads, and both casual and MMO subscription revenues. We expect this will add significant dollars to the PC game market size."

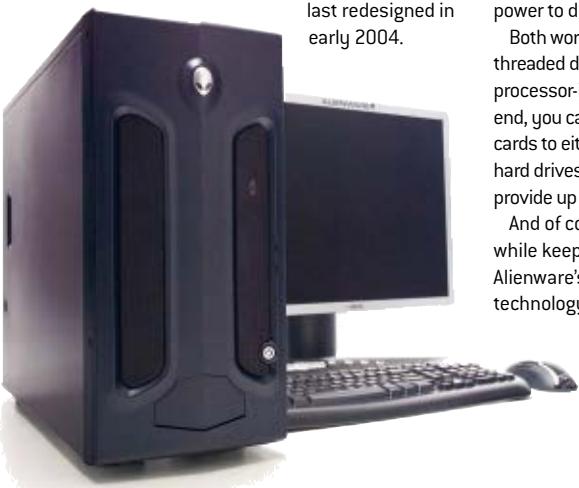
—Simon Carless

product news

NEW ALIENWARE WORKSTATIONS

ALIENWARE IS KNOWN FOR ITS SLEEK-LOOKING, self-cooling, indigo-glowing computer systems, and the company recently added two new desktop workstations to its repertoire: the Intel-based MJ-12 7500i and the AMD-based MJ-12 7500a (too bad the names aren't as stylish as the machines).

From the exterior, though, these systems sport last year's look; the chassis was last redesigned in early 2004.



On the inside, however, both systems have an Nvidia nForce4 SLI X16-based motherboard featuring two full bandwidth 16-lane PCI Express slots. You can get the 7500i with dual-core Intel Pentium processors, while the 7500a can be configured with dual-core AMD Opteron processors. The company makes a point that the dual-core technology in the MJ-12s gives users comparable power to dual CPUs, but at a lower cost.

Both workstations are outfitted to execute multi-threaded digital media applications and other processor-intensive projects. On the graphics card end, you can add an Nvidia Quadro FX 4500 graphics cards to either machine. The computers also feature hard drives in RAID 0 and 1 configurations, which provide up to 2TB of total data storage.

And of course, both systems purr ever so quietly while keeping internal temperatures low using Alienware's chilly sounding Liquid Cooling technology.

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www.alienware.com/7500ai.

—Jill Duffy

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STURM UND DRANG

An Open Letter to the Game Community

IMAGINE THIS HORRIFIC POST-HOLIDAY SCENARIO: PRESENTS HAVE BEEN unwrapped and mostly ignored, all except those addictive video game systems. Every other minute, the dear, wee ones are sneaking downstairs to spark up another shocking bout of *ANIMAL CROSSING*, where furry creatures interact with one another in a curiosity-filled environment. Or perhaps they sing alarmingly off key to *KARAOKE REVOLUTION* or demonstrate their [lack of] rhythmic talent in *DANCE DANCE REVOLUTION*. Maybe the young lady of the house solves a Nancy Drew mystery, instead of playing with the latest surgically enhanced Barbie. Or, worse, an older sibling explores the sinister mysteries of capitalism in *ROLLER COASTER TYCOON*.

Sounds innocent so far, but before the new cappuccino maker cranks out its first cup of automated Christmas coffee, Junior will likely shave the dog, light out for the liquor store, pump some lead into the community elders at the local nursing home, then march into the neighborhood Al Qaeda recruiting center. Pretty scary, huh?

How could this happen? Well, obviously, in a zombie-like trance, his parents must have purchased violent, or worse, "ultra-violent" [as Sen. Joe Lieberman likes to call them] video games for him and his siblings. You see, with misleading titles such as *GRAND THEFT AUTO*, any well-meaning parent might easily have confused certain mature games for innovative Baby Einstein substitutes.

Neither Sen. Lieberman nor Sen. Hillary Rodham Clinton, who are sponsoring the Family Entertainment Protection Act, play games, but what they may not realize, is that a lot of adults do. Ironically, Gov. Arnold Schwarzenegger, who has not only starred in "ultra-violent" movies but also licensed his image for the *TERMINATOR* games, has jumped on the family entertainment bandwagon as well.

The California courts, however, seem to agree that it's all much ado about nothing.

As teens inevitably turn into 20- and 30-somethings, they will bring a familiarity with game genres to steer their own children toward fun and enriching family entertainment, which in many cases will happen to come in the form of a video game. The current unease over video games, like previous incarnations of this same argument over rock'n'roll, will fade into the generational mist.

Fans of Quentin Tarantino films may enjoy a subversive, guilty (and for many, artistic) pleasure at the theater, but you rarely see them hauling out the kindergarten class for a *Kill Bill* birthday bash. The same thing will happen with interactive entertainment as knowledgeable consumers guide their children to the best entertainment that reflects their values.

As game developers, do we have an obligation to pay attention to any of this *sturm und drang*? Yes, to the extent that paying attention means listening to what the consumer wants. But that's far different from listening to what potential regulators want the consumer to want. There's no right way to gauge community standards, but marketers and retailers of games need to make best faith efforts to target an appropriate audience for their work. Meanwhile, opposition to games should be channeled to the same constructive outlets as in other mass media (and I can't believe I'm saying this)—critics, not politicians.

—Jon Goldman, CEO of Foundation 9 Entertainment



POPCAP PROBES GAMES FOR HEALTH

CASUAL GAMES PUBLISHER POPCAP GAMES AND developer and research collective The Games for Health Project have jointly announced an effort to gather, evaluate, and share research on the use of digital games and cognitive health, following the Japanese success of games such as Nintendo's *BRAIN TRAINING*.

According to the two parties, the collectively funded effort will result in a publicly available knowledge base, summarizing both the research and market development activities associated with how digital games could be used for maintaining healthy minds.

Initial findings will be made available in early Spring 2006.

"We know from basic research that active minds are more often healthy minds, especially as people age," says Ben Sawyer, co-founder and director of the Games for Health Project. "The goal of this effort is to establish a baseline of knowledge ... PopCap's support is going to help us accelerate our activity to get a handle on this as a benefit to the entire field of games and games for health."

"We have heard from many customers that they use our games for 'mental workouts' or 'brain exercise,' but we're not even sure what that means or if it's even relevant," says Jason Kapalka, co-founder and chief creative officer of PopCap. "It may be true, it may not. It may require special types of games and/or other supporting activities or regimens. By partnering with The Games for Health Project we'll gain access to existing data and the emerging conduit for partnerships between healthcare researchers and game companies."

The project will run several months, during which time contributors to The Games for Health Project working with advisors will scour research, interview experts in the field, and examine current products. This work will be compiled into a knowledgebase and a summary report will be developed and presented at upcoming game conferences starting this spring. It will also be made public on The Games for Health Project web site.

"Our plan is to share this work with everyone so we all have the same baseline from which we can inform ourselves and our customers—and



perhaps build even better, more beneficial, games," Kapalka says.

The companies also noted that the goal of the work is only to summarize past and present efforts, not to test the validity of any specific game (PopCap's or otherwise) for which there is no actual body of existing research.

—Simon Carless

HIGH DYNAMIC RANGE IMAGING

"HDR" HAS LATELY BECOME MORE

and more of a buzzword in our industry [we'll uncover what it means in a moment]. Valve has begun to implement this technology in its engine, releasing Source expansions of its titles, which utilize HDRI in very compelling ways. Crytek has released an HDRI update patch to its first-person shooter FAR CRY, and a number of Xbox 360 titles, including Epic's forthcoming Unreal Engine 3 game GEAR OF WAR, also use HDRI in various ways.

For the acronym phobic among us, HDRI stands for high dynamic range imaging and will be, according to the authors of this book by the same name, one of the key technologies in the future of game and media creation.

HDRI deals with the capture, storage, and display of visual imagery at a higher bit depth than we currently have the ability to display on a standard monitor.

Simply put, and according to Nvidia, HDR can be defined as the following: "Bright things can be really bright, dark things can be really dark, and details can be seen in both."

This book review examines *High Dynamic Range Imaging* from two points of view: an artist's and a programmer's.

ARTIST'S VIEW

BY SPENCER LINDSAY

Well-written and easy to follow, the introductory chapter is a great initiation for any technical artist who really wants to know how HDRI technology works. Chapter 1 guides you through the various layers of digital imagery [bit depth, resolution, and so forth] and uses well-known issues like color banding to describe how HDRI can bring astonishing realism to your lighting and rendering solutions.

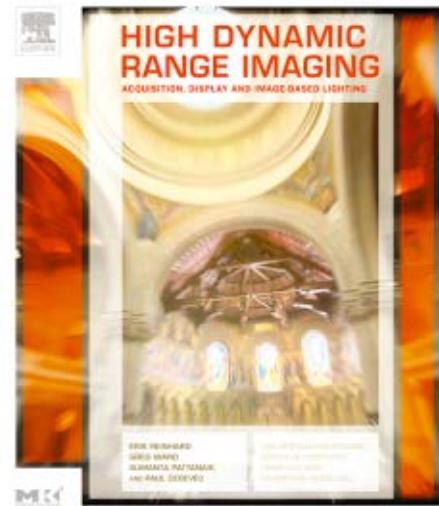
A must-read for technical directors who need to keep up-to-date with the constantly changing landscape of 3D

and compositing is Chapter 9, "Image-Based Lighting," which goes into great detail about the application of HDRI to 3D environments as a lighting model.

The production quality of this book is also very high. Full of glossy pages and excellent color plates, the book suits me as a visual learner. I found it much easier to digest than other, more dry texts on graphics I've read.

Chapter 4 ("HDR Image Capture") explains how HDRI images are captured and aligned. In most game development scenarios, the level of detail that the authors provide is somewhat overkill, but then again, this book is not really targeted at your average game artist. Its audience, according to the publisher, is researchers and developers in computer graphics and the entertainment industry, technical directors in film and photography, and anyone who works with images.

That being said, I'm a relatively technical artist (says so on my name tag), but a large portion of this book is devoted to the nitty-gritty of the math behind the acquisition, storage, and projection of HDRI images and left me a little spun. If you start twitching at the thought of an integral sign, you might want to let your programmer friends read Chapters 5, 6, 7, and 8 (respectively, "Display Devices," "The Human Visual System and HDR Tone Mapping," "Spatial Tone Reproduction," and "Frequency Domain and Gradient Domain Tone Reproduction"). My head nearly exploded when I read sentences like: "The CIE XYZ matching functions are defined such that a theoretical equal-energy stimulus, which would have unit radian power at all wavelengths, maps to tristimulus value (1,1,1)."



PROGRAMMER'S VIEW BY DENNIS CROWLEY

Generally speaking, unlike poor Spencer in the previous section, we programmers are masochists. We enjoy the sensation of having our heads explode. And trying to digest all the research in an emerging field is a good way to make this happen. Finding relevant papers and understanding their implications and impact takes time, patience, and an abundance of gray matter. *High Dynamic Range Imaging* is intended (and succeeds) in organizing and presenting the emerging field of HDRI and its applications, making our introduction (or continuing studies) that much easier. We may be masochists, but we are also quite practical.

The book is a fairly comprehensive survey of HDRI as it stands today, presented by Erik Reinhard, Greg Ward, Sumanta Pattanaik, and Paul Debevec, who are truly luminaries in the field (pun intended). It's well written and easier to digest than most books of equal technical intensity.

A reasonable number of references (208 for the whole text) is critical for a book of this nature, particularly for Chapter 9, "Image Based Lighting."

As mentioned, the primary audience for this book is the computer graphics community as a whole. Real-time issues get little coverage, and I don't recall even a mention of hardware shaders. Even so, as consumers of CGI technology, this volume gives game programmers a

BOOK REVIEW



STATS

TITLE

High Dynamic Range Imaging: Acquisition, Display, and Image-Based Lighting

AUTHORS

Erik Reinhard, Greg Ward, Sumanta Pattanaik, and Paul Debevec

PRICE

\$69.95 hardbound

PUBLISHER INFORMATION

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www.elsevier.com
2005
520 pp.

ISBN: 0-12-585263-0

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- Accuracy is amazing for detail work in 3D.

CONS

- A bit pricey for a mouse.
- Too twitchy for most applications.
- Difficult to understand how to tune it properly due to a lack of easily accessible help menus.

comprehensive starting point for our research, with plenty of road signs pointing in the various directions we might find useful.

While the bulk of the book has very little to do directly with games, the authors make a convincing case that a revolution in imaging and visualization is in the making. Whether really a revolution or merely a significant evolution remains to be seen, but HDRI and image-based lighting (or IBL, which depends on HDRI) has already found its way into some pioneering games, and the results, so far, are very cool.

The book's setup is as follows: First there's an overview of HDRI and the motivations for its emergence; then it teases us with the current and developing applications. We move next into a background of radiometry, photometry, colorimetry, and related material such as color spaces and gamma. While this stuff can be a little dry at times, it's pretty important to understand if you want to get into the nitty-gritty details later on. The treatment is, in my opinion, a good trade-off between brief and thorough, since this early material is meant to be review.

Game programmers will be most interested in Chapter 3 "HDR Image Encodings," which covers HDRI image file formats, and Chapter 9, the IBL chapter. Depending on what you want to do, you'll probably find some material from Chapters 6, 7, and 8 (tone mapping) rather important also. Tool programmers will definitely find Chapter 4, "HDR Image Capture," of particular interest.

The problem of tone mapping, taking an HDRI image and preparing it for display on a low dynamic range (LDR) device, such as your monitor, has three chapters (6, 7, and 8) devoted to it. This discussion starts by describing how the human

visual system manages to adapt to various lighting environments, which are intrinsically high dynamic range, and goes on to describe and classify various tone mapping operators that can be used to turn HDRI data into LDR images.

Those three chapters were the most challenging for me. While most of the equations yielded to a little mental pressure, I grew tired, and jumped ahead to Chapter 9 with a solemn promise to return.

Chapter 9 could easily be a whole book in itself, and herein lay my only gripe. Given the limited space, many IBL techniques and concepts are only briefly sketched in considerably less detail than the rest of the book. You will almost certainly need to study the referenced papers if you plan on using this material in your own work (but that's something you'd probably want to do anyway). The good news is that there are ample references to follow up with; I simply wanted more without having to work for it.

The included DVD-ROM (not CD-ROM) contains over 4GB of material, most of which is taken up by HDRI images in various formats, but there is also source code, binaries, and supplemental material. The binaries implement many tone mapping operators, and a utility is provided for converting to and from the presented JPEG-based HDRI format.

I must say I found the source code a little disappointing. Although there are binaries provided for Linux, Mac OS X, and Windows (a rarity, and a very pleasant surprise), the code won't build as-is without tracking down the undocumented dependencies, and you'll have to edit the makefiles or build your own projects. Since this work had to be done to provide the binaries, I am left to wonder why they weren't included with the source (but once again, as a masochist, I can enjoy the sweet pain of build issues).

NATURAL VISION

The human eye can perceive light values from below 10^{-3} , like on a starry night, to above 10^2 , as on a bright and sunny day. Yet, the maximum intensity of most common CRT monitors, displaying only 256 levels of red, green, and blue per pixel is 10^2 . With current imaging technologies, we're missing a lot of visual detail in our display systems.

Not only can the use of HDRI increase the reality factor of our games, it can also add to gameplay in new ways as Valve has shown with its recently released *LOST COAST* demo.

Although *High Dynamic Range Imaging* is likely a bit technical for the average game artist, it's perfect for programmers, technical artists, or technical directors who are interested in applying this fascinating technology to their games. The text is as essential on the bookshelf as the *Graphics Gems* series has been.

DENNIS CROWLEY is a CG and game programming consultant and mercenary in the greater north-of-San Francisco region. He likes to hang out where art, science, and engineering intersect—that's where the action is. Email him at dcrowley@gdmag.com.

RAZER'S COPPERHEAD, HIGH-PRECISION MOUSE
By Spencer Lindsay

Are peripheral devices becoming too specialized for the average human? Can a digital artist use the same mouse in work and play without a handicap in both areas? Do I need to spend \$80 on a new mouse? Read on and I'll try to illuminate your bulb as to how useful I found the Razer Copperhead mouse.

BLING BLING!

Opening the bubble-wrap that cradled my new Copperhead, I was first struck by the high bling-factor in the design of this piece of gear. Looking like an accessory for someone's slammed

CONTINUED ON PG 86

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Meilin Wong, Developer, Crystal Dynamics



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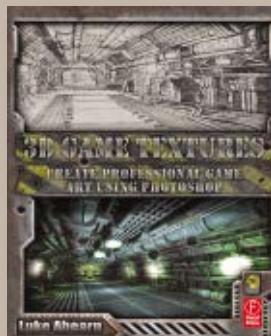
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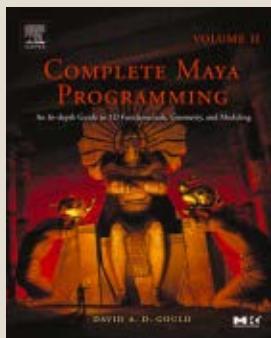
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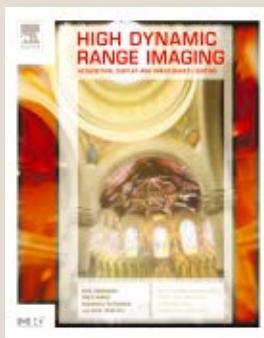
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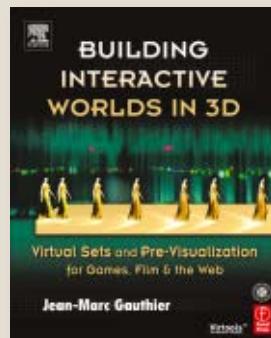
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Sumanta Pattanaik & Paul Debevec



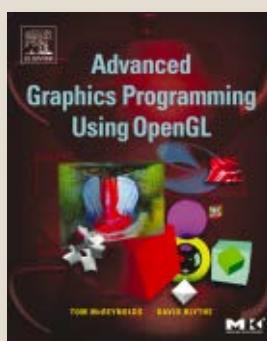
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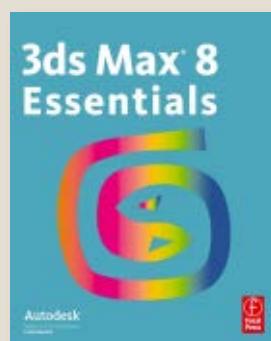
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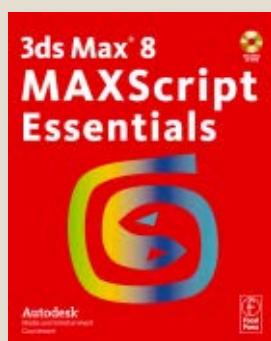
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GAME DEVELOPERS CONFERENCE

PREVIEW 2006

IT'S THAT TIME OF YEAR AGAIN, WHEN THE DANGEROUSLY

overloaded brains of gaming and business converge in the San Francisco Bay area. The Game Developers Conference this year is being held at the San Jose Convention Center March 20 through 24.

As in previous years, we, the editors of *Game Developer* (operated by CMP Media's Game Group, which also produces GDC) present an independent look at the show, highlighting some of the new and returning elements for 2006's extravaganza. Each of us, plus the editors of sister site Gamasutra.com, select the lectures, roundtables, and tutorials that we think will be the smartest, coolest, most informative, or most valuable, and highlight them for you here.

The theme of this year's GDC is What's Next—note the lack of a question mark. Now, this might easily be dismissed as fluffy marketing-speak were you excessively cynical, but in this transitional period between console hardware iterations, working out how to deal with what's next technically, creatively, and logistically, is pretty darned important. It's vital to figure out what's next before the PlayStation 3 and Revolution releases sneak up on us and catch us with our

collective next-gen pants down, successful game-wise.

Actually, we're particularly excited for GDC '06 due to the renewed influx of notable Japanese speakers, including a rare postmortem of *ANIMAL CROSSING: WILD WORLD* thanks to Nintendo, plus a look at Namco's fascinating Japanese arcade conversion of Valve's *COUNTER-STRIKE*. The keynotes, too, are always a central part of our experience; as of press time, the GDC organizers were still being somewhat cloak and dagger about precisely who will deliver the keynotes, but we hear that two of the big three hardware companies are lined up to deliver new information. The Vision keynote from *Battlestar Galactica* re-imaginer Ron Moore should be just as valuable.

Overall, GDC gives us, once again, time to network and wander around the show floor, check out indie games, party, and participate in creative and technical discussions. Heck, we like it because there's such a diversity of things to do every year. Also, Will Wright's session is scheduled in a really freaking big room this year, so that'll help.

—Simon Carless

GDC MOBILE

MONDAY AND TUESDAY MARCH 20 AND 21

GDC'S DEDICATED MOBILE TRACK CONTINUES TO blaze trails with intriguing content. Though many professional game developers dismiss mobile as a fledgling medium with a dubious interface, the lure of small teams and short production cycles remains high. At last year's GDC Mobile, Square Enix's Kosei Ito unveiled the first large-scale mobile MMO, BEFORE CRISIS: FINAL FANTASY VII, to the West for the first time, and this year's event promises similar spectacles.

The keynote speech this year will be from Mitch

Lasky, chair and CEO of Jamdat Mobile, who will address the recent acquisition of his company by EA as well as the ways in which he thinks the console and mobile industries will interact in the future.

Other highlights of the two-day conference include a roundtable on music games for mobile, featuring speakers from major labels such as Universal Music Mobile, EMI-Capitol Music, and the Warner Music Group. Kosei Ito will be back to discuss the future of mobile games in Japan, and

Gamevil's Kyu C. Lee will speak on the success of one-button mobile games in Korea. It's not all gung-ho though, with John Szeder, CEO of Mofactor giving a talk titled "The Outspoken Speak Out: Where is My \$10 Billion Mobile Games Industry?"

GDC Mobile will certainly be interesting to those already in the mobile space, but traditional game developers should have cause to poke their heads in as well.

—Brandon Sheffield

WEEK IN REVIEW

MONDAY THROUGH FRIDAY, MARCH 20-24

BECAUSE GDC CAN SOMETIMES BE overwhelmingly jammed with parties, events, and get-togethers, we've culled some of the major ones for you here.

On Monday and Tuesday, game creators, pet projects in hand, will have the opportunity to show off their latest titles to publishers. A two-day event, Game Connection allows both sides of the industry (developers and their sugar daddies) to hook up and talk business. Attendees must pre-register for this event, which begins at 9 a.m. in the Fairmont Hotel and is hosted by Lyon Game.

Last year, the GDC creators pushed for a stronger Japanese presence both in speakers and audience presence. This year the conference will again welcome a large number of developers from the other side of the Pacific. Following the Japanese Orientation from 7 to 7:30 p.m. on Tuesday will be the East Meets West party, an invitation-only celebration to welcome Asia-located developers (8 to 10 p.m.).

Wednesday evening, GDC exhibitors will participate in the annual Booth Crawl in order to give busy attendees the tour-guide version of the Expo Floor. Held from 5 to 6:30, the Booth Crawl gives you the chance to browse all the new products, speak to vendors, and grab the freebies—all at marathon speed—ending just in time for the awards shows. This overview is a

lifesaver for those of us on a tight schedule during the daytime.

Wednesday night's apex is twofold. The Game Developers Choice Awards and Independent Games Festival will be held back-to-back in the same location, the San Jose Civic Auditorium, starting at 6:30. Presented by the IGDA and produced by the CMP Game Group, the Choice Awards and IGF will be emceed by Dave Perry of Shiny Entertainment and the effervescent Tommy Tallarico.

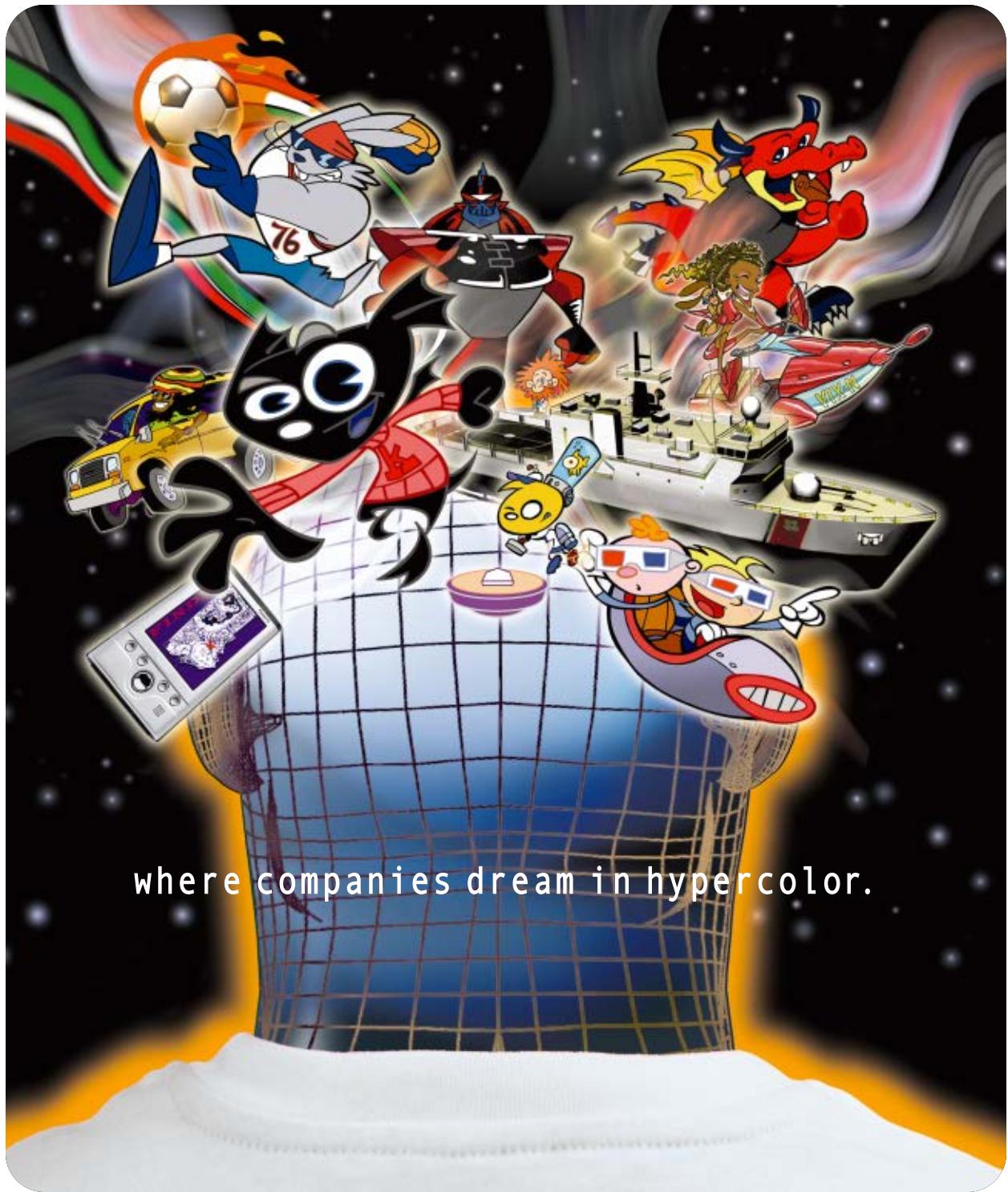
Sony PlayStation's annual party is slated for Wednesday night, while the Microsoft Xbox's is set for Thursday. Both these blowout bashes are, of course, invitation-only, though that hasn't ever stopped wristband-less throngs in the past from showing up at the door with a hope and a prayer—on at least one occasion, myself included.

Rounding out the week in orchestral style, is Video



Games Live at GDC. Video clips of celebrated games, plus special effects, plus the local philharmonic ... the Symphony Silicon Valley orchestra will pull together all these seemingly disparate pieces Friday at 8 p.m., closing out the frenzied week in a suitably grand manner. Tickets from \$20 are available through www.videogameslive.com.

—Jill Duffy



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EDITOR'S PICKS

EDITOR SIMON CARLESS' PICKS

GOD OF WAR: How the Left and Right Brain Learned to Love One Another (lecture)

Tim Moss (Sony Computer Entertainment America)

Friday March 24, 12–1 p.m.

The buzz on the creation of SCEA's excellent PlayStation 2 title *GOD OF WAR* seems to have been that it's a seriously great game with a notably fraught development process. Thus, when this lecture from the game's lead coder popped up, calling the title "a designer's dream [and] a programmer's nightmare," my ears pricked up. Unmissable for those wanting to know how to create greatness from (just a little!) conflict.

ESRB and Game Developers: Getting it Right the First Time (lecture)

Bill Garrity (ESRB)

Friday March 24, 10:30–11:30 a.m.

Needless to say, the ESRB is under the greatest scrutiny in its history, following the controversy over the "hot coffee" mod for *GRAND THEFT AUTO: SAN ANDREAS* and the game's subsequent re-rating. Though *Game Developer* has recently covered exactly how games are rated (see "Rated and Willing," December 2005), this lecture is vital for

developers and publishers wanting to get their info straight from the horse's mouth, and see their titles rated fairly and swiftly.

SPORE: Preproduction Through Prototyping (lecture)

Eric Todd (MAXIS / EA)

Thursday March 23, 4–5 p.m.

Oh SPORE, let me count the ways I theoretically love thee, even though thee hasn't been released yet and I don't actually know whether I do yet. Though Will Wright's keynote elsewhere will probably have more on the subject, it's fascinating to many that the great-looking demonstrations of SPORE shown at GDC 2005 were actually of an extremely complex prototype, and the team has since "started again" with a largely fresh code base to make the game proper. Todd's talk on the advantages of such an approach should be fascinating.

Successful Outsourcing on Triple A Games—A Case Study of FORZA MOTORSPORT (lecture)

Rajesh Rao (Dhruva Interactive) and

John Wendl (Microsoft Game Studios)

Friday March 24, 9–10 a.m.

Although the upstarts at Wideload Games have been honest about the contracting and outsourcing they used in developing *STUBBS THE ZOMBIE*, there has been relatively little public discussion of major publishers' use of off-continent outsourcing. This lecture from Indian developer Dhruva's Rajesh Rao alongside Microsoft Game Studios' Wendl should illuminate the process, discussing both the cost savings and wrinkles created by this swiftly burgeoning approach to handling art assets.

Physical Gameplay in HALF-LIFE 2

Jay Stelly (Valve)

Friday March 24, 9–10 a.m.

Lest we forget, Dreamworks' *TRESPASSER* whipped up the "first-person shooter with physics" thing long, long before Valve's *HALF-LIFE 2*, with extremely unfortunate results, which suggests that making a physics system for a game that's easily adaptable to gameplay purposes is much trickier than you might expect. Fortunately, Valve's Stelly is on hand to discuss the technical aspects of creating what is probably the single greatest innovation in *HALF-LIFE 2*—its physics. Hopefully, he'll also explain why barrels are still fun to play with, 25 or so years after *DONKEY KONG*.

SERIOUS GAME SUMMIT

MONDAY AND TUESDAY MARCH 20 AND 21

THE FIELD OF SERIOUS GAMES IS

certainly an interesting one, with schools, corporations, the military, and developers all taking a major interest. The GDC Serious Game Summit schedule is equally varied, with a host of birds-of-a-feather meet-ups for similar interest groups, tutorials, and two keynotes from industry leaders. Philip Rosedale, CEO of Linden Lab, will speak about how his company is incorporating serious games into his consumer MMO *SECOND LIFE*, and why synthetic worlds and created communities work well for these sorts of applications.

In his own keynote Jesper Juul, noted game theorist, discusses ways in which serious games could be expanded to

appeal to a larger audience by utilizing new developments from the conventional games space.

Outside the realm of keynotes, there are some particularly noteworthy sounding talks; this one caught my eye: "Can Serious Games Work in 45 Minutes?" It features James Paul Gee and other distinguished academics, who will discuss whether serious games can be effective in short windows of time, as most school classes tend to only be that long. In an interesting duality, the session itself is set for only 45 minutes. The proof will be in the pudding.

Gee also has a talk about what's wrong with the current state of serious games,

while Doug Whatley, CEO of serious games supernaut BreakAway Games, along with CEOs of Cyberlore and Tabula Digital, will discuss successful business models in their own roundtable. Aside from the usual faces, there are plenty of enticing talks, including Dr. Edd Schneider's (State University of New York at Potsdam) discussion of when virtual worlds get too real, and several talks on advergaming.

—Brandon Sheffield



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EDITOR'S PICKS

MANAGING EDITOR JILL DUFFY'S PICKS

Burn Baby, Burn: Game Developers Rant (panel)

Eric Zimmerman (GameLab), Frank Lantz (area/code), Jessica Mulligan, Chris Crawford, Seamus Blackley (CAA), and Jonathan Blow

Thursday March 23, 5:30–6:30 p.m.

Once per GDC, you really have to attend a session based solely on the speakers' personas. Personally, I was tickled pink to hear that Eric Zimmerman, who speaks with the liberal gusto and tonal quality of Al Franken, and Jessica Mulligan [sarcastic and feisty, yet as highly self-respecting as Ru Paul] would be in the same room with Jon Blow and company for this rant. But let's not forget the purpose of the rant, which is, other than to air one's grievances, to identify holes in the art, science, and business of making games. Heckling from the audience is encouraged.

Field Recording For Games (lecture)

Chuck Russom (Sony Computer Entertainment America)

Wednesday March 22, 12–1 p.m.

I asked Chuck Russom, who has been making and recording sounds for games for seven years, to tell me what he has in store for this lecture, and his shop-talk blew me away. From firearms to exotic animals to the tech specs of different microphones, this audio guru was awash with knowledge and enthusiasm for field recording. "My main goal of the talk is to inspire others to push to have custom sound recording become an integral part of their game development process." Hear hear! Can we blow something up now?



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Sex in Games: Hardcore (roundtable)

Brenda Brathwaite (Savannah College of Art & Design)

Thursday March 23, 4–5 p.m.

Brenda Brathwaite—formerly lead designer of PLAYBOY: THE MANSION, now professor—knows about sex in games. In past talks, she's made her position clear: Sex is not bad or wrong or shameful; people like sex; sex can even be funny; and sex coupled with games can turn a dollar like a hooker can turn tricks. Simply hilarious and always boisterous, Brathwaite is sure to draw a crowd. Plus, the official description of this session came with its own warning label. Juicy!

Designing TABULA RASA:

Lessons from the World of MMOs (lecture)

Speaker: Richard Garriott (NCsoft)

Thursday March 23, 9–10 a.m.

For all developers involved with massively multiplayer online games, this design lecture should be mandatory. Straight from the mouth of Lord British himself, we'll finally learn how NCSoft's TABULA RASA came together—an intriguing story to be sure, considering the game has been in development for a number of years, and was apparently subject to a major design reboot.

Building a Flexible Game Engine: Abstraction, Indirection, and Orthogonality (lecture)

Tim Sweeney (Epic) and Martin Schweitzer (Epic)

Wednesday March 22, 12–1 p.m.

There's nothing I appreciate more than a little pointy-headed theory. This advanced-level programming talk promises to look at three core techniques that are vital to building a flexible game engine: abstraction, indirection, and orthogonality. Blending high-level theory with real world application, Sweeney and Schweitzer, both from Epic, will finish off with a discussion of how these theories translate into the way programmers build next-generation games.



SketchUp Software Certification Exam

1. "Luke, I am your _____."
 - a. cousin
 - b. llama
 - c. father

Answer Key: 1. c.

EDITOR'S PICKS

ASSOCIATE EDITOR BRANDON SHEFFIELD'S PICKS



Experimental Gameplay Sessions (panel)

Jonathan Blow

Wednesday March 22, 2:30–4:30 p.m.

The medium will never evolve unless we play with conventions! Jon Blow's experimental gameplay presentation has long been a GDC favorite. As the first place KATAMARI DAMACY was shown to the U.S. public, this session is increasingly becoming a showcase for what's next. The panel promises presentations from the professional, indie, and academic camps, though specific presenters were not available as of press time.

Creating a Global MMO: Balancing Cultures and Platforms in FINAL FANTASY XI (lecture)

Sage Sundi (Square Enix)

Thursday March 23, 4–5 p.m.

In this lecture, a Square Enix representative reveals details about the company's rather unprecedent plan to introduce a single MMORPG across three platforms (PC, Xbox 360, and PlayStation 2) and three territories (Japan, Europe, and the U.S.), all interacting and using the same international servers. The talk will focus not only on the difficulties of such an undertaking, but why this could really open up the MMO market to a new, traditionally console-oriented audience. This should be a particularly useful lesson in cross-cultural community management and global development strategies.

Emotion Boot Camp: Putting More Emotion into Play (full day session)

Nicole Lazzaro (XEOdesign) and Katherine Isbister (Rensselaer Polytechnic Institute, NY)
Monday March 20, 10 a.m.–6 p.m.

This all-day session originates from two women with varying ideas about putting emotion in games. Nicole Lazzaro of XEOdesign brings her experiences watching the ways that gamers play, while Katherine Isbister comes from a position of academia, with studies from Rensselaer Poly's Games Research Laboratory. Aside from their dedicated research, both women also have had some interaction with professional development, with Lazzaro having worked on the localization of Broderbund's RIVEN, and Isbister speaking to many industry groups, including Sony Japan's research division. However you slice it, if there's a way to bring more emotion to the table, I'm for it.

The Localization of COUNTER-STRIKE in Japan (lecture)

Kouichiurou Taninami (Namco)

Thursday March 23, 12–1 p.m.

In 2004, Namco developed a specific set of arcade locations expressly to deliver COUNTER-STRIKE NEO to the Japanese market. For the same purpose, they created a new PC Linux architecture-based arcade board in partnership with Nvidia. Localizations of Western games into the Japanese market tend to be rocky at best, and this was no small undertaking—the release was a test of the online market in Japan for Namco and play information was recorded in an online database for future use. In an era of flagging arcade sales, and a changing world market, did this bold move give Namco a boost, or did it burst their bubble?

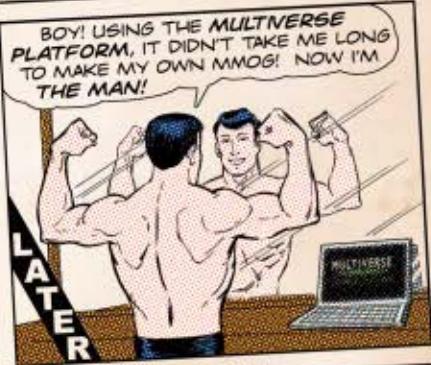
You Deny, but You're Loving It—Using Psychophysiology for Product Evaluation (poster session)

Byung-ho Park (Indiana University)

Thursday March 23, 2–3 p.m.

Here's a curious session, interesting for its boldness if nothing else. It proposes psychophysiology—the study of psychological responses by using physiology (natural body reactions, such as the heart beat)—as a method through which companies and researchers could evaluate games for a more honest response. But will gamers submit themselves to it? The speaker comes from a 20-year background in game journalism in Korea, and a five-year stint at Samsung Electronics. This experience, tempered by his current doctoral studies in communication, should make his talk a rather unique one.

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Inspirations for Next Generation Designs (lecture)

Peter Molyneux (Lionhead Studios)
Friday March 24, 10:30–11:30 a.m.

A big idea guy, Peter Molyneux has always been quite forthcoming about the vast possibilities of video games. While commonly associated with the "god" game, he steps into new territory at this year's Game Developer Conference, set to guide session-goers through Lionhead's recent experiments to revolutionize the next-generation fighting genre. I must admit that I have no idea what to expect and am looking forward to it.

The Game Design Challenge: The Nobel Peace Prize (panel)

Eric Zimmerman (GameLab),
Cliff Bleszinski (Epic Games),
others TBA

Thursday March 23, 2:30–3:30 p.m.

This year's largely mysterious participants of the annual Game Design Challenge have their work cut out for them as they offer their idea for a game that can win the Nobel Peace Prize. Is there such a game that can make a serious contribution toward world peace? A birthing ground for unique and fascinating ideas, the audience (who also judge the competition) is in for a treat!

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All About NINETY-NINE NIGHTS: Next-Gen Character Design (lecture)

Tetsuya Mizuguchi (Q Entertainment) and SangYoun Lee (Phantagram)

Wednesday March 22, 4-5 p.m.

Considering that the development of Ninety-Nine Nights spanned the Japanese offices of Tetsuya Mizuguchi's Q Entertainment, the Korean offices of Phantagram, and a number of outsourced resources, this postmortem of the Xbox 360 action/fantasy game promises to be an epic, world-spanning adventure in time zone and spoken language coordination.

Is That a Franchise in Your Pocket? An Animal Crossing: Wild World Case Study (lecture)

Katsuya Eguchi (Nintendo)

Thursday March 23, 5:30-6:30 p.m.

The director of the ANIMAL CROSSING discusses moving the franchise to the

portable medium with last year's ANIMAL CROSSING: WILD WORLD for the Nintendo DS. The talk promises to be both technical and philosophical, exploring the addition of the Nintendo WiFi Connection service from both angles, as well as the future of building communities through online gaming and of games lacking specific endings in general.

The Game Studios Download: Top 10 Research Findings

Jane McGonigal, Mia Consalvo, Ian Bogost (Georgia Tech)

Friday March 24, 4-5 p.m.

Get inside your consumers' heads as a trio of self-regaled game scholars present their top 10 list of the most interesting research results of the past year and how these findings can relate to game design and business today. Additionally, we'll get a sneak peek at the high level research currently underway in the field. Think of it as "game player behavioral psychology for fun and profit." ☺

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DYNAMIC SKYSCAPES

» **A DYNAMIC SKY WITH CLOUDS, A SUN, STARS, AND A MOON CAN** improve the visual experience of a game substantially. This article describes a dynamic sky system that wastes as little computing time as possible and is executable on a Shader Model 2.0 graphics card. I developed it during a placement at Radon Labs, Berlin, for an open source graphics engine—Nebula2. My system can display different kinds of weather or even an alien atmosphere, giving you a lot of versatility in the appearance of your sky. However, in a game that uses this system, the characters won't be able to fly through clouds.

In this article, I will describe vertex- and pixel-shader programs for the following elements:

- sky color: a simple pixel-shader program that's easy to handle
- sun and moon: simply a plane facing the viewer [which needs a bloom effect to look good, though the bloom effect itself is slightly outside the scope of this article]
- stars: a possible method to display stars in a cheap, but appealing way
- clouds: the main element of a realistic sky, but unfortunately also the most difficult one

• atmospheric perspective: not a sky element, but very useful to paste the sky seamlessly into the main world and also helpful in creating a fantastic ambience (check out the art from a planned game from Remedy called ALAN WAKE, for example).

Any geometry used in this article moves relative to the viewer and uses the same model space, so the viewer is always in the middle of the sky dome. I won't provide shader programs in their entirety, only the essential parts of them, and all are written in HLSL. User parameters are displayed as code.

SKY COLOR

Let's begin with the background, the sky color. I use a very simple model, which contains no simulation techniques. It's a simple gradient from the top of the sky dome to the horizon. To make it more stimulating, I add a circular shine around the position of the sun. There are six variables that describe the sky color: `top_color`, `horizon_color`, `sun_position`, `sun_color`, `sun_range` and `sun_intensity`.

I use a sphere around the viewer, with a radius of one, as geometry. A dome isn't sufficient because we need the computed sky color later for the atmospheric perspective. The

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certification, which dealt
with the sky system*

presented here.

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DYNAMIC SKYSCAPES

vertex-shader program doesn't have anything to do but provide the coordinates in model space to the pixel shader.

First, we need three normalized vectors: the sun vector, a vertical vector pointing to the top of the sky sphere, and a vector to the current point of the sphere to be rendered in this pixel. To get the color gradient, we compute the dot product and truncate it at 0 and 1. The result is the weight between `top_color` and `horizon_color`.

Next, we need a sun radius, so we compute the distance between the current point of the sphere and the sun vector and subtract it from the `sun_range`, truncate it again and multiply by the `sun_intensity`. To get a better curve, square the computed value. The result is the weight between the computed sky color and `sun_color`.

At dusk and dawn when the sun stands at the horizon, the shine is not circular but vertically skewed. The effect should be stronger the nearer the sun is to the horizon ($\text{saturate}(1-\text{sun.y})^2.5$). The sunshine also has to be reduced the farther the current point is from the horizon ($v.y$). The product is squared (to get a better curve again) and subtracted from the computed weight. Now the resulting color can be computed by weighting sky color and `sun_color`. See Listing 1.

To make the shader more comfortable to handle, you could add variables for saturation and brightness. If you want to display a second sun or a moon at the same time, you should compute a shine radius for every celestial body.

LISTING 1

```
float4 psSkyColor(const VsOutputSky psIn) : COLOR
{
    float3 sun = normalize(SUN_POSITION.xyz);
    float3 top = float3(0,1,0);
    float3 v = normalize(psIn.modelPos);

    // compute the color gradient from top to horizon.
    float dotTV = saturate(dot(v, top));
    float4 skycolor = lerp(HORIZON_COLOR, TOP_COLOR, dotTV);

    // compute the sun shine radius and intensity.
    // compress it vertically when sun is at horizon.
    float distSV = sqrt(pow(v.x - sun.x,2)
        + pow(v.y - sun.y,2) + pow(v.z - sun.z,2));
    float weight = pow((saturate(SUN_RANGE - distSV)
        * SUN_INTENSITY),2);
    weight = saturate(weight
        - pow(saturate(1-sun.y)*2.5 * v.y, 2));

    // compute the fading from skycolor to suncolor
    // and return the result
    return lerp(skycolor, SUN_COLOR, weight );
}
```

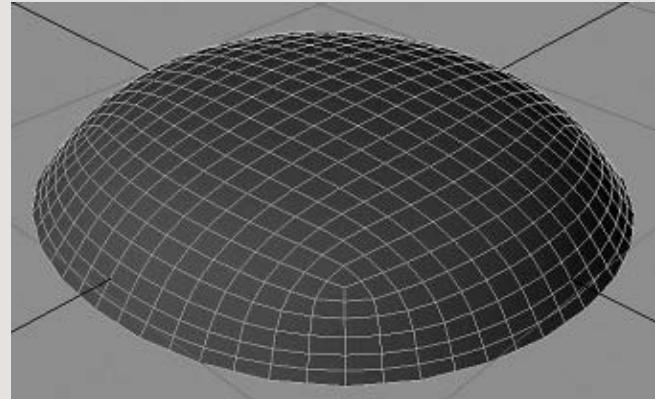


FIGURE 1 This image shows the dome I used for cloud rendering.

SUN AND MOON

Celestial bodies like the sun and moon just need a plane, always facing the viewer, and a texture showing form and surface. The most important thing for the sun is a good bloom effect. For this purpose you may need color values above 1, and that means you need HDR or good color compression. The bloom effect has to be done post-process.

STARRY NIGHT

At night, we expect to see stars in the sky. A picturesque star-dome dotted with tiny stars requires a high-resolution texture. But a huge texture would waste too much memory.

We could use a tileable texture [256x256], but the result would be an unsightly pattern. To avoid such a pattern, we can use a second texture [256x256], which provides the distribution of the stars. To maximize the variety of stars, we can use three channels of the tile texture for different sizes—small, medium, and large.

The fourth channel contains many big stars close to each other. This channel is for generating constellations by simply painting them onto the fourth channel of the distribution texture. The other three channels of the distribution texture

CONTINUED ON PG 27

LISTING 2

```
float4 psStars(const VsOutputStars psIn, uniform bool hdr) : COLOR
{
    float4 startile = tex2D(StarTileSampler,
        psIn.uv0 * STAR_RESOLUTION);
    float4 stardistr = tex2D(StarDistSampler, psIn.uv0);

    float4 result = startile * stardistr;
    result.a = result.r + result.g + result.b + result.a;
    result.rgb = 1;
    result *= STAR_COLOR;
    return result;
}
```

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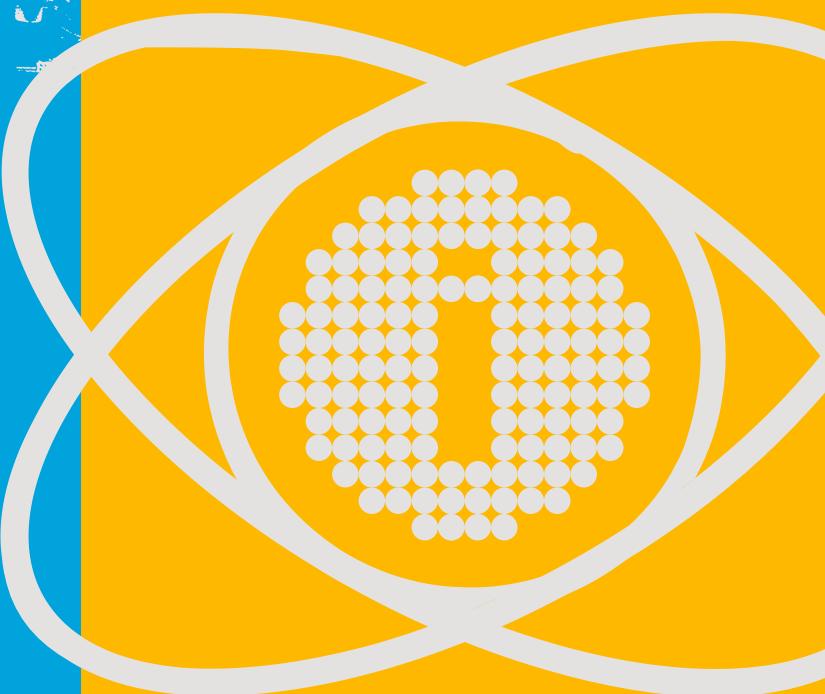
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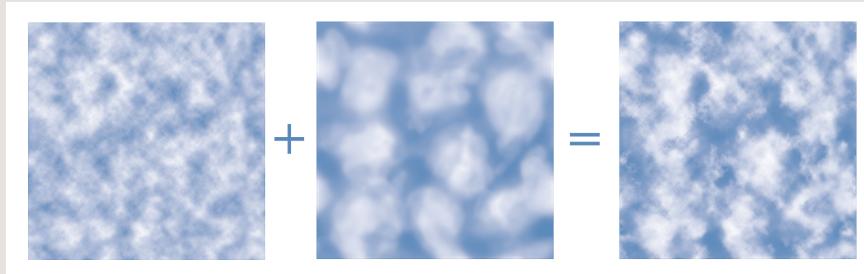


FIGURE 2 Both textures together will result in very nice cloud maps.

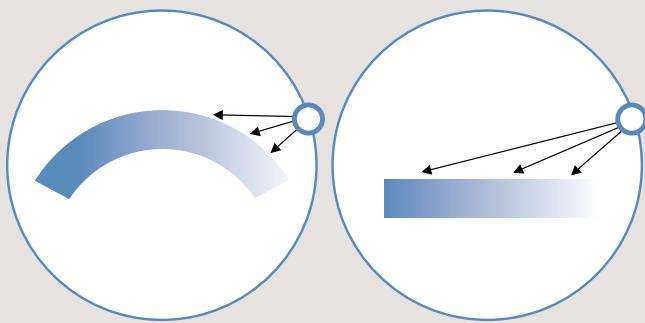


FIGURE 3 The lighting is changed by modifying the vertex positions.

CONTINUED FROM PG 24

define a multiplier for the different channels of the tile texture. You can control the distribution of the different stars without the need for a huge texture. As geometry, a dome that provides absolutely uniform UV-mapping is needed to avoid stretching the star textures.

The UV-coordinates have to be given from the vertex shader to the pixel shader. There, both textures have to be read out. To tile the tile texture, the UV-coordinates have to be multiplied by a `star_resolution` parameter. The greater the parameter, the smaller the tiles and the stars. I use a value of 8 in general, but you may have to vary it according to your texture.

If you multiply the values of both textures, you can distribute the stars. Next, we have to add up all channels containing the different star types and store them into the alpha channel of the resulting pixel. Finally, you can tint the stars by multiplying the value of the current pixel by the `star_color` parameter. The alpha channel makes it possible to fade out all stars. See Listing 2 on page 24.

CLOUDS

The most exciting elements of the sky are clouds, but they're also the most difficult to simulate, especially if you want to visualize different kinds of clouds. We'll need many complex parameters to change the look of the clouds at runtime.

Geometry. Let's start with the geometry. It's possible to use a plane or a generated dome, but I got the best results with a hand-modeled flat dome. Use a smoothed cube with a radius of 1 instead of a sphere and try to make the polygons as uniform as

possible so it's easier to get a good UV-map. Try to arrange the UV-map uniformly at the plane's center and compress it at the sides, to create the illusion of a far horizon. This skill may require both practice and tweaking to reach a good result (it did for me, at least).

The normals of the model are irrelevant, because we will compute them on the fly within the pixel shader program (see Figure 1, page 24).

Textures. Like nearly every 2D cloud simulation, I chose the Perlin Noise Algorithm to create structures similar to cloud distribution. But we won't compute them at runtime because it's too expensive. Instead, we can use a high-resolution Perlin Noise texture [1,024x1,024] and create a normal map from it for the cloud surface (for example, with a Photoshop plug-in). The high map has to be stored in the alpha channel. Make sure to avoid using texture compression (like DXT); it will destroy your normal map and/or your high map.

A second normal map texture [256x256 or 128x128] contains the shape of the clouds. Just paint some smooth white spots on a black background. Make sure that both textures are seamless tiles to avoid nasty edges in the clouds.

An offset filter is very helpful.

In the pixel shader, both textures will be added with varying



DYNAMIC SKYSCAPES



offset to create new cloud structures while preserving their rough shape. So we achieve clouds moving over the sky, continuously changing their structure, but never disintegrating at all. With a slightly different moving direction and speed of the two textures, we get nearly unlimited combinations. See Figure 2 (page 27). There are many more effects we can achieve with these two textures, too.

LISTING 3

```
struct VsInputCloud
{
    float4 position : POSITION;
    float2 uv0 : TEXCOORD0;
};

struct VsOutputCloud
{
    float4 position : POSITION;
    float4 uv : TEXCOORD0;
    float3 lightvector : TEXCOORD1;
    float glow : TEXCOORD2;
    float alpha : TEXCOORD3;
};

VsOutputCloud vsCloud(const VsInputCloud vsIn)
{
    // Vertex-shader output
    VsOutputCloud vsOut;
    vsOut.position = mul(vsIn.position, ModelViewProjection);
    // compute UV-coordinates
    vsOut.uv.xy = (vsIn.uv0 * MAP0_UV_RES) + CLOUD0_POS;
    vsOut.uv.zw = (vsIn.uv0 * MAP1_UV_RES) + CLOUD1_POS;

    // flatten expand the dome for computing the lightvector
    float3 newPos = vsIn.position;
    newPos.y = -1.5;
    float3 sun = normalize(SUN_POSITION)*3;
    float expand = clamp((sun.y+2) *2,1,50);
    newPos.xz *= expand;
    vsOut.lightvector = normalize(sun - newPos);

    // compute glow value
    sun = normalize(SUN_POSITION);
    float3 V = normalize(vsIn.position.xyz);
    float distSV = sqrt(pow(V.x - sun.x,2)
                        + pow(V.y - sun.y,2) + pow(V.z - sun.z,2));
    vsOut.glow = GLOW - GLOW *
        pow(saturate(distSV/SUNRANGE),2);

    // compute alpha modifier
    vsOut.alpha = ALPHA - ALPHA * saturate(
        (0.25-saturate(vsIn.position.y))*3.0);
    return vsOut;
}
```

Vertex shader program. After transforming the position, we compute the UV-coordinates for both textures. For this purpose, we have two parameters for each texture: the UV-resolution [map0_uv_res] for changing the size of the tile-texture and the UV-position [cloud0_pos] for shifting the clouds over the sky.

Next, we'll do a trick with the vertex position of the cloud dome. The following manipulations only concern the computation of the light vector and won't change the real positions of the vertices. The vertical position of the vertex is set to a constant of -1.5, so the lighting is smoother and it starts earlier, when the sun is already under the horizon, to simulate a dawn or dusk. See Figure 3 (page 27).

But we have to perform another even stranger trick. To get a good 3D effect, the sun must not be a directional light, but a point light, so the clouds will be lightened from different sides.

We can normalize the sun_position and set it to a fixed distance of 3. Especially the top of the cloud (from the viewer's position) has to be lightened. To implement this effect, just expand the vertices in the xz-plane.

The higher the sun stands, the stronger the effect has to be. We use the y-component of the sun_position to compute the expand value. The term has two constants that I got by trial and error. Now we can expand the vertices by multiplying with the computed expand value. After that, we can calculate the light vector, by subtracting the new position (newPos) from the sun_position and by normalizing the result.

When the sun stands in line with clouds, they seem to glow stronger than the other clouds. To simulate this effect, calculate the radius around the sun, similar to the sunshine in the sky color shader. Divide the distance from the sun_position to the current point on the dome by the sun_range and truncate it at 0 and 1. For a better curve, square it and multiply by the glow variable. Now we've got something like an inverse glow value, so we subtract it from

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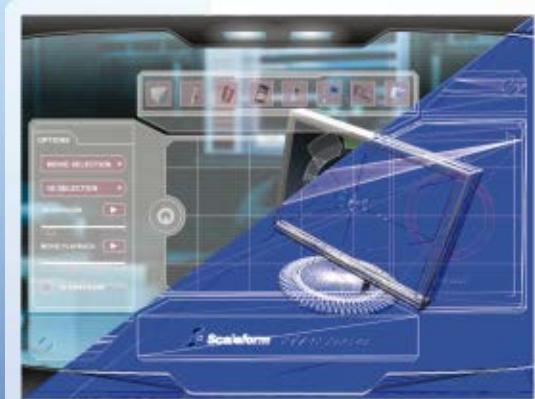
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CONTINUED FROM PG 28

the maximum glow value to get the actual value. Finally, we add a constant of 0.3 to guarantee a minimum glow all over the sky. You could also use a parameter to vary this value.

At the horizon, the clouds should become partially transparent to avoid a grainy look and to include the atmospheric perspective. The higher the clouds are, the less transparent they seem, so we have to decide on a height under which the effect has to work. I used 0.25, but you can vary it. I also used a constant multiplier of 3, which I got by trial and error.

Now the term: The current height is truncated at 0 (we don't need negative values) and is being subtracted from the boundary of 0.25 and multiplied by the other constant of 3, again truncating from 0 to 1 and multiplying with the alpha value. Subtract this "inverse value" from the maximum alpha. See Listing 3, page 28.

Pixel-shader program. First we read out the two textures at the UV-coordinates that we computed in the vertex shader. Their alpha channels

LISTING 4

```
float4 psCloud(const VsOutputCloud psIn) :COLOR
{
    // read surfacemap and shapemap with normals and height
    float4 surfacemap = tex2D(SurfacemapSampler, psIn.uv.xy),
    float4 shapemap = tex2D(ShapemapSampler, psIn.uv.zw);

    // compute gauge and cloudcolor
    float gauge;
    gauge = lerp(surfacemap.a, shapemap.a, GAUGE_WEIGHT) * 4 - 2;
    gauge += ADDER;
    float3 cloudcolor = CLOUD_COLOR.rgb - (gauge * DENSITY);
    gauge *= MULTIPLIER;
    cloudcolor += vsOut.glow/clamp(gauge*0.5,0.5,100);

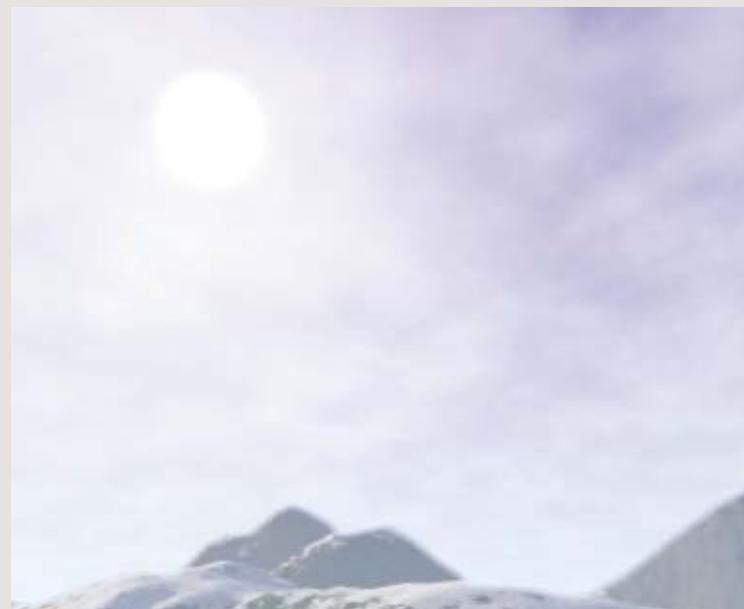
    // compute tangent surface normal
    float3 normal;
    normal = lerp(surfacemap.rgb, shapemap.rgb, BUMP_WEIGHT);
    normal = float3(normal.r, normal.b, normal.g);
    normal = (normal - 0.5) * 2;
    normal.xz *= BUMP_FACTOR;
    normal = normalize(normal);
    normal.y = (normal.y * -1)+0.7;
    normal = normalize(normal);

    // compute light intensity with dotnl
    // and a modifier for thin cloud areas
    float dotNL = dot(normal, psIn.lightvector);
    float sunIntensity = saturate(dotNL*0.5+0.75);
    float shadowIntensity = 1 - sunIntensity;

    // compute resulting cloud color
    float3 lightcolor = sunIntensity * SUNLIGHT_COLOR
        + shadowIntensity * SHADOW_COLOR;
    float4 result;
    result.rgb = saturate(lightcolor * cloudcolor);

    // compute alpha value
    result.a = saturate(gauge * psIn.alpha) * CLOUD_COLOR.a;

    return result;
}
```



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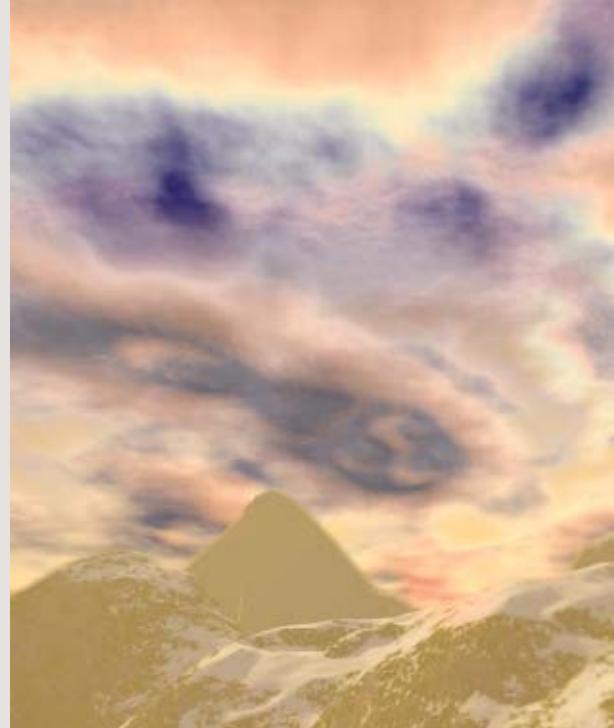
contain the high maps, we have to weight (`gauge_weight`), multiply by 4, and subtract 2. You should get a gauge value with a range of -2 to 2.

Next we add the adder-parameter, before we compute the current cloud color. For this purpose, the computed gauge has to be multiplied by the density. To get the final gauge of the cloud at the current pixel, multiply it by the multiplier parameter. Now we take into account the glow value from the vertex shader by dividing it by the half gauge (truncated at 0.5 and 100 to avoid a small divider) and add it to the cloud color.

Next, we have to deal with the surface normals. First, weight both normal maps as given by the `bump_weight` and swap the green and blue channels. (If you used a Photoshop plug-in, you could have done this in advance, of course.) Now we shift the values to a range of -1 to 1. To define the strength of the bump effect, multiply the x and z values by the `bump_factor` and normalize it thereafter.

Now we have to do a trick with the normals that will give the clouds a really cool look. Invert the y-component of the normal to make it point downward, add a constant of 0.7, and normalize the whole normal vector. The normals at the sides of the cloud are bent a bit upward, while the normals in the center mostly point down. You can experiment a bit with the constant, but 0.7 seems to be a good value.

Next comes the lighting. Compute the dot product of the computed normal and the light vector from the vertex shader. To make the lighting of the cloud less hard, divide the dot product by 2 and add a constant of 0.75 so you get the intensity for the `sunlight_color`. If you choose a smaller constant, the cloud will be more heavily shadowed. The Intensity of the `shadow_color`



is 1 minus the sun intensity. Use a moderate shadow color, maybe a little bit darker than the current sky color. To compute the actual light color, we multiply the color values by the intensity values and add them up. Multiply the computed cloud color by the light color and you get the final color for the pixel. For avoiding values above 1, you should truncate at 0 and 1.

Just one more thing to do: calculate the alpha value. Multiply the alpha value from the vertex shader by the gauge and truncate it at 0 and 1. Now you've got a smooth transparency at the horizon and at the edges of the clouds. You can also modify the transparency of the whole clouds by multiplying by the alpha channel of the original `cloud_color` parameter. See Listing 4 (page 31).

Possible enhancements. I described a basic version of the cloud shader, which is fast and flexible, but you can certainly enhance it.

For example, you can use a third or even a fourth texture to create even more variations. They do not necessarily need a normal map, but could just change the arrangement of the clouds. Or you can blend between two shapemaps or surface maps to enhance the look of cloud movement.

LISTING 5

```
float4 psAtmosphere(const vsOutput psIn) : COLOR
{
    float depth = DecodeDepth(tex2D(DepthSampler, psIn.uv).rg);
    float4 sky = tex2D(SkyColorSampler, psIn.uv0);
    sky.a = clamp((depth/MAX_DEPTH), 0, MAX_BLEND);
    return sky;
}
```



Or, you could create more realistic lighting by including the translucence of the clouds, calculating the path of the light through the cloud, and checking the shape map along the light vector and using the result for color calculation.

Finally, you might use some parameters that define coordinates, a range and a modification value. You can define cloud-free regions or regions of higher gauge by weighting all regions to avoid adding up the modifications at the intersections. This technique is very inexpensive and powerful because you can do it within the vertex shader.

ATMOSPHERIC PERSPECTIVE

The shader programs for atmospheric perspective have to be used post process, but we have to do some preparatory work. What we need is the render target with the calculated sky color as texture and the depth information for each pixel. You'll have to do an extra depth-render pass, as the current graphic cards do not allow reading out the depth-buffer.

Here, you have to render each object with a depth-shader program, in which you write the depth information into a render target and set the depth buffer to avoid rendering masked objects in your main render pass again. One 8-bit channel only offers 256 states, so we have to compress the depth value into two channels to get 65,536 possible states, or we can just use a 16- or 32-bit channel rendertarget.

The idea is to blend the sky color over the whole scene, with a weight according to the depth of each pixel. As geometry, we just need a plane matching exactly the projection plane. The vertex shader program simply provides the UV-coordinates to the pixel shader. We read out the depth texture and decode the two channels, containing the depth value. Read out the sky color from its texture and compute the alpha value. We can divide the depth by the `max_depth` and truncate it at 0 and a `max_blend_value`, which should be a value from 0 to 1, where 0 means there is no atmospheric perspective and at 1 the color at `max_depth` matches the sky color. The alpha-blending feature of the graphics card will do the rest of the work. See Listing 5.

PUTTING IT ALL TOGETHER

We're now ready to define the render path. It contains the order of the shaders and the render targets they are writing to. We need three additional render targets in addition to the standard scene render targets: a sky color render target with a very low resolution (128x96), a depth-render target with full resolution, and a sky-render target with a scaleable resolution. The resolution shouldn't be too low (minimum 256x192) and also not too high (maximum 768x576), because it would waste a lot of computation time without producing visible improvements. A good resolution for standard usage is 512x384.

The first render pass only contains the sky color shader and writes to its own low-resolution render target. The second render pass is the depth path as described in the section "Atmospheric Perspective." The third render pass renders the rest of the sky. Copy the sky color render target to the current sky render target to set it as background. Then render the star shader, sun

shader, and cloud shader in that order. Before rendering all other objects, copy the sky render target into your main scene render target. After finishing your main render passes, you have to use the atmospheric perspective shader as a post process. See Figure 4.

Tables 1 and 2 (available at www.gdmag.com) illustrate the technique settings and texture sampler you should be using to avoid trouble.

SHADER PARAMETER

The system that I created is meant to display a flexible and beautiful sky. It's adjustable by many tweakable parameters so you can get whatever results you need. And because of its modularity, it's easy to extend or reduce its features to achieve a tailored system. You can also scale cloud layers and the sky resolution to get the best compromise between performance and quality.

Try to integrate your own ideas to create an incredible looking environment for your next game project! ☺

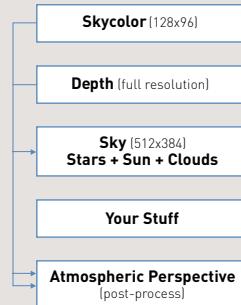
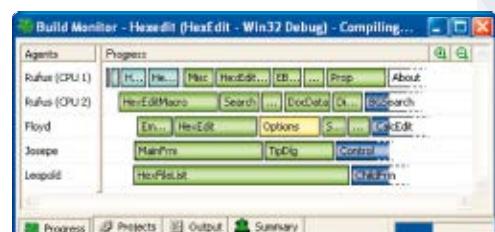


FIGURE 4 You will need several passes and render targets to create a skyscape.

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POSTMORTEM

GUN



THE GOOD, THE BAD, AND THE UGLY

SCOTT PEASE, director of development at Neversoft, lead the production of the first five *TONY HAWK* games and now helps oversee all three teams at Neversoft.

CHAD FINDLEY, project lead on *GUN*, was the lead designer of *SPIDER-MAN* (PlayStation), *TONY HAWK 3, 4*, and *THUG*, before designing and leading the production of *GUN*.

Send comments about this article to spease@gdmag.com.

WE HAVE A PRETTY GOOD TRACK RECORD at Neversoft. We've created eight hit games in seven years, including a damn good superhero game and a series of multi-million selling, genre-defining skateboard games.

In 2004, we ventured into new territory, riding into the uncharted wilds of an action/adventure/shooter/western. Our goal was to craft a third-person adventure game with stellar missions and an exciting story. We wanted to create new technology and a new world, brand it, make it work on four platforms, and ship it for Christmas 2005. Our goal was to make the game unique, fun, and epic—and make it a bestseller.

No problem, no pressure, right?

Most of the drive to make *GUN* great came from within the walls of Neversoft.

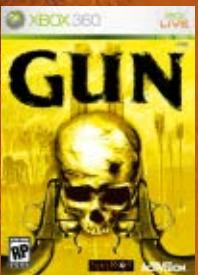
Activision was involved and supportive the entire time, but our team pushed forward each and every day in the quest to make something new and exciting.

WHAT WENT RIGHT

1 FUN MISSIONS. We set out to create missions for a third-person shooter/action/adventure title, and the closest we had come to making these kinds of missions previously fell somewhere between the SMASHTV-style missions for our first game, *APOCALYPSE*, and the game-specific missions in *SPIDER-MAN*.

Now, good design is good design, but unless you know what the rules are, you can't build strong missions, and that was one of our biggest challenges throughout.

GAME DATA



DEVELOPER
Neversoft

PUBLISHER
Activision

RELEASED
November 8, 2005

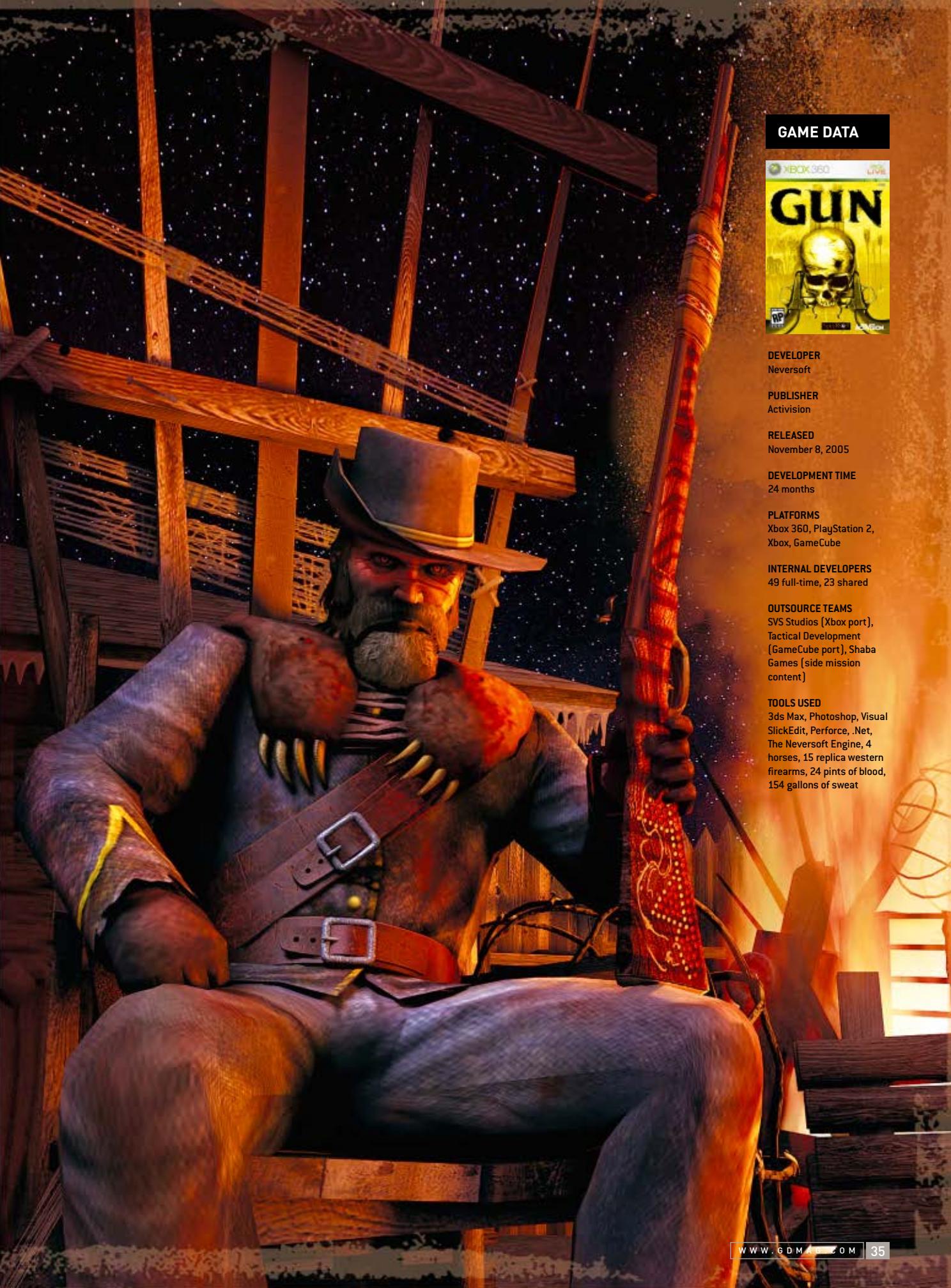
DEVELOPMENT TIME
24 months

PLATFORMS
Xbox 360, PlayStation 2,
Xbox, GameCube

INTERNAL DEVELOPERS
49 full-time, 23 shared

OUTSOURCE TEAMS
SVS Studios (Xbox port),
Tactical Development
(GameCube port), Shaba
Games (side mission
content)

TOOLS USED
3ds Max, Photoshop, Visual
SlickEdit, Perforce, .Net,
The Neversoft Engine, 4
horses, 15 replica western
firearms, 24 pints of blood,
154 gallons of sweat





POSTMORTEM

GUN

The cliff-side of the mountain range is shorter and more rounded off at the peaks. Because they are shorter they don't get as much snow on their surfaces. Pay mind to the lines created by the snow sitting on the ledges running diagonally along the surface.



The waterfall side is warmer and brighter to separate it from the forest below. The peaks are more vertical here, to allow for a steeper drop. The low plateau on the right is dusted with snow, and very horizontal to contrast with the verticals on the left.



Izzy

Neversoft is a very iterative company, redefining what we perceive to be good and fun with each new game. But this time we were starting with a blank slate. We had to come up with new rules as soon as possible so that GUN could be fun and challenging. So we visited our CALL OF DUTY buddies at Infinity Ward and mutually traded some game-making ideas. We concentrated on mission design flow and AI features, learning what made good structure to missions and what made interesting and unique AI.

At this point, we started to spec out a few missions and prototype them. We focused our first mission around what we thought would be the most important aspects of gameplay—gunfights, horse battles, and bosses—which resulted in a quick and dirty bar fight, a horse chase and resulting horse battle, and a boss for our “law and order” mission. This helped us to quickly define our AI requirements, focus the camera and player control requirements, define our memory limits, and clarify the mission flow UI and constraints.

Through this prototyping process, we started to see problems with the radar system, player speed and movement, the number of unique models and animations that would be required, and the weapon and gameplay requirements.

We had a large wish list of moments and icons that we wanted to see in the game: dirty bar fights, quick-draws, steamboat crashes, train robberies and collisions, hangings and murders, Native Americans and Irish and Chinese, stagecoach deliveries, whores, and buried treasures. That list is what GUN was ultimately structured around. The events and locations we imagined really helped us hone in on the story, gameplay, and world design.

2 STORY IS NOT FOR STORY'S SAKE. GUN's tale of revenge, history, and greed was crafted in collaboration with our writer, Randall Johnson. Although Johnson is a seasoned Hollywood veteran, GUN was the first video game he worked on,

so coaching him through the needs of our medium was critical.

We had an initial vision of what the missions were going to be, so before crafting the full story, we asked Johnson to write around these requirements. Most writers would liken this to crafting a story with handcuffs on, but he took it on as part of the challenge. It took many, many revisions of outlines and sub-stories, and lots of editing to tie it all together into something that worked on a dramatic level, yet effectively set up each section of gameplay. The result, hopefully, is that the game and story are united in purpose, with one side enhancing the other.

We also wanted to attack the notion that game stories are filled with boring, overly long cutscenes that beg you to press “skip” before your eyes glaze over. We spent a lot of time obsessing over the details of the 60-page GUN

shooting script. We tried to ask ourselves the same questions about each scene, page, and individual line of dialogue. Why does this exist? What information or emotion does this bring to the story? If we couldn’t answer these questions, we cut. Perhaps we cut bit too much, as we later learned that players wanted a little more context in the plot-heavy first act. Some last minute narration plugged the hole.

Within the story, we also employed a couple of cinematic conventions rarely used in games: flashbacks and cutaways. Playing with time and space allowed us to create a world that extended forward and backward in time. With these devices, we could tell more story, more compactly and visually than with a straightforward narrative. Players seemed to appreciate knowing that the characters we created, and their motives and desires, had a history.

We also learned that players like to see the characters move outside their immediate realm. We often made hard cuts to action that was literally hundreds of miles away to show how other, more powerful villains were reacting to your actions, and what they planned to do about them, hopefully heightening dramatic tension.

3 HIRING THE RIGHT PEOPLE AND CREATING A PROCESS. A little over a year before GUN’s release, we realized it was unclear how we were going to pull off 60 minutes of story without ever having produced a motion-captured story in any of our games before. Our solution? Hire some experts.

Neversoft invested in top-notch in-house motion capture equipment and hired creative experts to run it, which allowed us to capture data on stage in the morning and have it in the game by the afternoon. Taking this route was a big risk—without the right talent running our studio, the mocap pipeline could have been a convoluted mess. The team we hired was first-class, and there was no way we could have produced GUN’s story without them. We went from script to ship in less than six months.



CLAY ALLISON

MICROSOFT @ GDC 2006

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XNA



POSTMORTEM



CONTINUED FROM PG 36

Our process for creating the scenes involved a pre-production process borrowed from our friends at Luxoflux, a process they used to make *TRUE CRIME*. For each expected day of shooting, we first brought in our actors and spent a day blocking, rehearsing, and improvising. This blocking was critical for planning, and it also helped team members visualize how to make the scenes stronger. We experimented with multi-character and prop interaction (essential for "selling" your mocap) and interesting staging that reinforced the themes of the scenes. At this stage we would often trim or tweak the script on the fly.

After scenes were shot, we reviewed them in the game engine with scratch audio tracks, the equivalent of "dailies" in the film industry, or the process of looking at raw footage from the day's shoot—always a sobering experience. As in film, though, we used dailies to further focus, trim, and refine our scenes. A good rule of thumb that we applied is if it's boring as a daily, then the scene needs tightening or rethinking. But, if we were able to make these scratch scenes interesting to watch, then we knew when we added the other cinematic layers (facial animation, sound effects, music, special effects), the scenes had the potential to be really great.

4 TIGHT, FEATURE-BASED SCHEDULING. The game was scheduled in a very efficient, highly prioritized way, which allowed us to finish everything that absolutely had to get done and make cuts with little or no backlash.

Throughout *GUN*'s two-year development, constant production schedules framed the big picture of where we were tracking to and what wouldn't get done with the resources we had. At several junctures, we made critical decision to cut features that would have been huge time sinks (such as some story missions, a train, and AI that could navigate on vehicles) in order to salvage or polish more important, critical path features.

Being able to cut was extremely useful because having a scalable game meant we could keep trying to hire the people we wanted to get, but even if we never got the extra forces, we at least knew the game would get done and that what made it into the game would be done correctly.



NED WHITE

5 A COMBINATION OF VETERAN GUNSLINGERS AND FRESH BLOOD.

The core *GUN* team comprised battle-hardened, ship-on-time-or-die Neversoft veterans, who were essential in maintaining team sanity in the face of major obstacles, and in training new hires in the Neversoft way.

On the flip side, the majority of the *GUN* team was ultimately devised of new hires. We brought in people from many different companies and backgrounds, and the knowledge that many of our new employees brought with them was invaluable in helping us find our way through systems with which we had little experience. We had to go from nothing to a fully shippable and competitive hybrid game in about a year and a half, so we couldn't afford many bad decisions or unfruitful paths. New talent brought with them ideas on how AI should be structured, how missions should be scripted, how targeting should work, how streaming could be improved, how art could be more efficiently created, and how characters could be designed and visualized.

Without this teamwork and sharing of knowledge from both sides, I doubt we could have made what we did in such a short time.

WHAT WENT WRONG

1 NOW HIRING ... FOREVER! It's hard to classify hiring as a "what went wrong" because so much of our hiring went right. However, the demands of *GUN* made the goal of hiring enough people pretty much unobtainable.

When the development of *TONY HAWK'S UNDERGROUND* ended, Neversoft was at a crossroads. Many senior people had devoted up to five years to Hawk and needed a new challenge. Yet, there was a rallying cry among other employees to not give our skateboarding franchise away. Without knowing fully what would come from it, we made the snap decision to double up the company and reorganize it quickly into three teams: *HAWK*, *GUN*, and *Tools & Engine*.

Since *TONY HAWK'S UNDERGROUND 2* had to ship in a year, the *GUN* team started small, staffing up as quickly as possible. The goals for the project were ambitious. There was a new setting to grapple with and new systems, including a streaming world, new AI, and the Xbox 360. Coupled with our high standards for new hires and a philosophy to not simply "fill seats" and break the company culture, we just simply couldn't hire fast enough.

Around E3, with time running short and still not enough staff, we made the decision with Activision (our publisher and parent company) to call on our friends at Shaba Games to help add game content. They graciously pitched in and in a short time built an entire series of side missions and a poker mini-game to help flesh out the world. Their work was much needed, but we made the call too late. With only a couple of months before alpha, there just wasn't enough time to iterate on that amount of content, and they had to learn the idiosyncrasies of our new technology on the fly, with little help from us.

In the end, it felt like we had a fully functioning team cranking on all cylinders for the last three to six months of the project when we really needed a solid year of production. Although we preserved everything we felt was necessary for a great game, a good deal of content was cut or compressed, and the game

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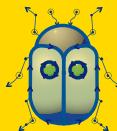
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grew shorter as a result. There's really not much more that could have been done—Christmas wouldn't budge. But many GUN reviews have hammered on the shortness of the game and pointed out some of the rough edges that we had to leave unpolished due to the time and staffing constraints.

2 CAN I GET SOME FEEDBACK, PLEASE? With human resources in short supply, we let a critical Neversoft convention fall apart: game and mission reviews. Previously on the TONY HAWK games, we scheduled weekly mission reviews with the project leads, designers, and artists to refine the levels and focus the work for the week. On GUN, we were too overloaded with various responsibilities, outsourcing, firefighting, and hiring, so mission reviews were harder and harder to schedule. Of course, due to our skimping on the mission reviews, we ended up with even more work at the end of mission creation cycles to fix problems that could have been easily caught earlier in the process.

On the story side, at the end of the project when the schedule got tight and we were rushing to finish, cinematic reviews became abbreviated or were dropped. As a result, many subtle story elements slipped through the cracks.

The age-old solution: start and finish earlier.

3 THE STORY CAN ALWAYS BE BETTER. The real meat of any story is not in the plot. It's in the characters and their actions. Although we constantly trimmed the plot of GUN, it was still a bit too complicated for its own good.

Early on we cut certain subplots, combined and condensed characters, and tried to make the through-line clear. Still, at least one more character should have been whacked. Additionally, as missions were cut from the game due to time constraints, cutscene sequences got "stacked up" and played back to back. In one case, the player is introduced to a major character as a friend, and then a few missions later is double-crossed by the so-called friend. But due to time constraints,



the three intervening missions morphed into one short mission, meaning the introduction and double-cross happen in about 15 minutes of gameplay. Ouch.

We also suffered from poor continuity, which was a problem on multiple levels. On the technology side, we always had to fade to black before playing a cutscene to hide certain elements of the world loading and unloading. This broke continuity, and although we hoped the story would be strong enough to overcome this limitation, many reviewers have mentioned it. We also seemed to maintain good continuity within our story scenes, but when it came time to integrate them into the missions, the scenes came in too late; a number of game continuity holes were left unaddressed. We knew from our experience working on the TONY HAWK games that cutscene-to-gameflow is always hard to foresee, yet we made some of the same mistakes again.

In the future, should we produce a story for GUN's sequel (please shoot me if we do), we'll have senior staff members and our writer dedicated themselves to that element full time for the entire project, making all the connections stronger and hopefully ensuring airtight continuity.

4 FOCUS TESTING STARTED TOO LATE. On almost every single game we worked on previously, we religiously scheduled focus testers to come in every week starting the instant the game was even remotely playable. The purpose of early focus testing is to start getting an idea of what is fun and what is not. We were under-staffed on GUN for a large part of the game, which meant that focus tests were largely unwatched. As a result, the fun-factor went largely overlooked.

Once we started to feel concerned about how fun the game was, we started looking for ways to address the oversight. Fortunately, Activision's Central Tech department had just started a design division and we were fortunate enough to tap into their workflow and know-how to help us out. As the project hit alpha, we started weekly focus tests run by people who knew design and knew the correct questions to ask. Even just having people off the street playing the game on a weekly basis with someone qualified noting the problems was immensely useful. We amassed detailed reports on where players got stuck and what part of the mission or story they didn't understand.

Player feedback helped us to refocus the missions (and redo a few) to keep the difficulty appropriate, the variety clean, the repetitiveness to a minimum, the training of new mechanics and game-wide mechanics pushed into correct places, and the story integrated where necessary. It also helped us keep an eye on the entire game-flow as a



whole. In the end, it all worked out, but the focus testing should have begun much earlier. It would have saved us a lot of time and effort fixing problems at the end of development.

CONTINUED ON PG 43

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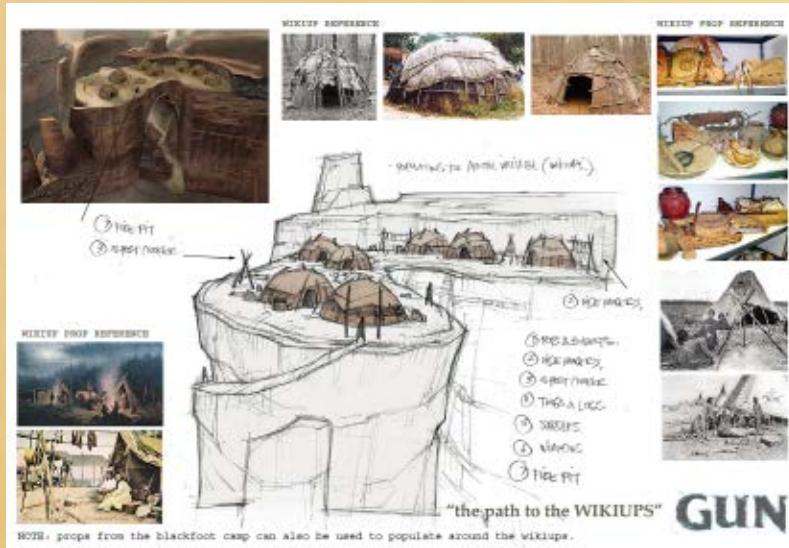
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POSTMORTEM



CONTINUED FROM PG 41

5 THE DIFFICULTY ISSUE. What's worse than a game that's too short? One that's too short and too easy. Due to a tight schedule and inexperience with the genre, we took a very simplistic approach to game difficulty, putting the standard "Easy, Normal, Hard, and Insane" selection at the front of the game. Then we proceeded to focus test and tune the game so that your average off-the-street adventure gamer would have a challenging, but feasible experience on Normal, and a more experienced shooter player could enjoy Hard. Then we sat back and depended on the players to select the appropriate challenge level for their particular tastes. What the hell were we smoking?

In the video game market, asking players to set their skill level before they've even played your game is a freaking naive way to go about it. GUN was made to appeal to a wide market audience, from 133t shooter heads, down to Red State casual gamers, so the expectations were varied from the get-go. Exacerbating the "too easy" problem further was the design decision to make the game low hassle. Checkpoints were frequent, and we sought to eliminate any turgid backtracking or unnecessary map wandering.

We knew something was wrong when our first reviewer came through on a final build, selected Normal, and basically blasted through the game without a scratch. About half way through the session, we offered to bump him up to Hard, as that was obviously the appropriate challenge for him. He declined, saying he really needed to get through the game as quickly as possible to get his review done. Gulp. We could immediately foresee legions of highly skilled game reviewers sprinting through our game at breakneck speed, making the "short game" issue even worse.

Now admittedly, making the game more challenging and forcing more mission retries might also have backfired too, but our gut reaction to the reviews was that too many people played at the wrong difficulty level—and it was our fault.

Although we'll definitely dedicate more resources to a set of difficulty systems in the future, even just changing the names of the selections to something more descriptive ("I play a lot of third and first person shooter games," etc.) would probably have helped more people find the appropriate level of challenge.

LAST STAND

With GUN, Neversoft put its heart, soul, and reputation on the line. We built a kick-ass team from the ground up, struggled with and overcame many hurdles in design, production, technology, art, and storytelling. We brought a game to market at a tough time, going up against many sequels and established franchises. We're extremely proud of the game we made and perhaps more importantly, excited by the potential power of the team that created it.

We hope you've enjoyed our little tale of good fortune and disaster, and encourage you to do what we do: ride hard, draw first, and try not to shoot yourself in the foot. See ya in the saloon! ☺

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YOU NEVER CALL ANYMORE. WE WORRY.

FRANK CIFALDI

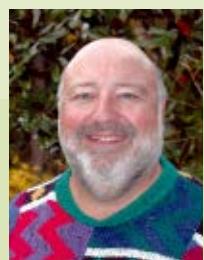
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There's nothing worse than losing touch with old friends ... especially old friends who make great games. Well, we decided to do something about it. Since July 2005, sister web site Gamasutra.com has been running a series of retrospective interviews with respected names from the industry's past called "Playing Catch-Up." These interviews fall somewhere between a career retrospective and a "where are they now" profile. Tracking down the big names from gaming past that have fallen out of the spotlight, we uncover what they've been up to lately. Some, we've found, are retired, enjoying life to its fullest. Others have moved on to a new industry, working film or even updating humor web sites. Many, however, are still creating games.

Here, we revisit some of our favorite interviews: Al Lowe, Steve Purcell, and David Crane.

AL LOWE

SIERRA ON-LINE DESIGNER AND LEISURE SUIT LARRY CREATOR



ALTHOUGH HE IS CREDITED AS THE LEAD DESIGNER ON FREDDY PHARKAS: FRONTIER PHARMACIST and TORIN'S PASSAGE (both critically acclaimed adventure games from the days when their publisher, Sierra On-Line, was synonymous with such accomplishments) Al Lowe is unarguably best known as the creator of the LEISURE SUIT LARRY franchise.

LEISURE SUIT LARRY chronicled the adventures of one Larry Laffer, a lovable loser whose first adventure, 1987's LEISURE SUIT LARRY IN THE LAND OF THE LOUNGE LIZARDS, was almost the antithesis of the other Sierra franchises of the time. Rather than recovering a king's treasure or battling pirates in deep space, Larry's only aim was to lose his virginity. Some dumpster diving, drunken gambling, a bottle of Spanish Fly, and a blow-up doll later, Larry won the hearts of both a new lady friend and an enthusiastic audience the world over.

The game's success inspired six sequels, all but the last of which were designed and written by Lowe himself. Lowe's work with the series climaxed with 1996's LEISURE SUIT LARRY 7: LOVE

FOR SAIL. Part four of the series was mysteriously skipped, inspiring a running joke that made appearances in games even as distant as the SPACE QUEST franchise. Later that same year, Sierra founders Ken and Roberta Williams sold Sierra On-Line—including all its game franchises—to a company called CUC International, which would eventually sell Sierra to Vivendi Universal. As a result, Sierra's once all-star team of game designers, including Scott Murphy, Mark Crowe, and yes, Al Lowe, were terminated during a massive layoff in February 1999. Lowe has not designed a game since the 1998 spin-off LEISURE SUIT LARRY'S CASINO, leading us to wonder just what he's been up to these past seven or so years.

"I didn't fully retire in '99, actually," Lowe says. "I spent all of the year 2000 creating the world's best scheduling software, just in time for the dot-com bust." The site, www.JackNabbit.com, was described by Lowe as having a logo featuring a white, Wonderland-like rabbit, with a big clock on his back. "Isn't that just so... dot-com?"

Since then, Lowe has also been running Al Lowe's Humor Site (www.allowe.com), where he continues to arouse chuckles with text, audio, images, and a free daily email joke list called CyberJoke 3000, which has amassed more than 5,000 subscribers in its five-year run, with no publicity or press to fuel it. The site also provided a way for Lowe to connect to his fans for the first time.

"I worked really hard trying to produce games people would like," he says, "and try to make them laugh. I'd work on these games, and I'd get these spreadsheets with the sales numbers, in the thousands and eventually the millions. Before I started this web site and began getting emails, I never made the connection between those numbers and people. It was such a surprise to see just this amazing outpouring of gratitude for doing what I loved to do."

Additionally, Lowe has been doing a lot of volunteer work, is an active member of the National Model Railroad Association, and plays in a 16-piece jazz band in the Seattle area. He didn't, however, have anything to do with LEISURE SUIT LARRY: MAGNA CUM LAUDE (2004), despite vague contract negotiations with Vivendi Universal Games.

"They actually wanted me to sign a contract stating that I

would never publicly say anything negative about the game," Lowe says, "before I'd even seen it!" Eventually, he did see it. "It was like receiving a ransom video from your son's kidnappers. You're happy he's still alive, but at the same time, he's being tortured. The kind way of saying it is I was extremely happy our negotiations fell through. Had I got involved, I would have wanted to change almost everything."

Would Lowe go back into video game design? "Oh, absolutely. I would love to do another game," he says, rather enthusiastically. "I've got some great ideas to bring comedy back. I was so happy to see PSYCHONAUTS, and I really think we need more of that kind of game. If I could find a publisher to give my ideas a chance, I'd jump right back into it."

Originally published July 15, 2005



STEVE PURCELL

LUCASARTS ARTIST / SAM & MAX CREATOR

STEVE PURCELL NOW WORKS AT PIXAR, BUT IS BEST KNOWN FOR his art work at LucasArts (then LucasFilm Games) on titles including THE SECRET OF MONKEY ISLAND, before he parlayed his long-running comic book characters Sam and Max, whom he now owns the rights to, into the classic LucasArts 2D graphic adventure SAM & MAX HIT THE ROAD.

After graduating from the California College of Arts and Crafts in the early 1980s, Steve did freelance illustration and comic books for Marvel in the San Francisco area for years before he succumbed to the alleged allure of the video game industry, and went to work for LucasFilm Games.

As for his entry into the industry and his role as part of the "golden age" of LucasArts, Purcell explains, "I was hired by LucasFilm Games to work on a role-playing game with cat-head babes that was immediately canceled shortly after I was hired. Since I could paint, I got called back to do the ZAK MCKRACKEN cover. I worked on game art and animation for INDIANA JONES AND THE LAST CRUSADE and then for THE SECRET OF MONKEY ISLAND, which I also painted the cover for. I also did game art for THE SECRET OF MONKEY ISLAND 2, LOOM, PIPEDREAM, and was doing a bunch of painted SAM & MAX strips for [internal LucasArts magazine] 'The Adventurer' along the way."

Purcell also has the unique privilege of being credited for "whip research" on the INDIANA JONES AND THE LAST CRUSADE game.

"When we were making LAST CRUSADE, LucasFilm Games was located on Skywalker Ranch. In one of the display cases in the main house there were a bunch of artifacts including an authentic Indy bullwhip. I asked the research librarians where those whips were made and I ordered one. A little old man in Seattle weaved them by hand out of kangaroo hide. It was a lot

of money at the time, 300 bucks, but I bought it under the dodgy pretense of 'reference,' but actually because I always wanted a real bullwhip. I spent the summer behind the stable house learning to crack it and I actually got to where I could clip off the tops of weeds."

As for his continuing LucasArts involvement into the early 1990s, Purcell explains that it was a little more abstract than some people might presume.

"After THE SECRET OF MONKEY ISLAND 2, I sort of drifted away from LucasArts, but came back to do SAM & MAX HIT THE ROAD which I tried to be involved with at every level. After that, I stuck around for a bit and worked on a kid's game, MORTIMER, with my wife Collette Michaud."

From there, Purcell branched out into freelance work again, producing a bunch of character designs for TOEJAM & EARL, and characters for other game companies, including what he describes as "reams of concept art of various never-to-be-seen action game characters."

Further into the 1990s, and following his work on the Sam & Max animated series, which was produced in Toronto and the winner of a Gemini (the Canadian Emmy), Purcell next went to Industrial Light and Magic to work on the story crew for a *Frankenstein* animated feature. When the movie was canceled, according to Steve, "They kept a few of us around to develop stories for animated features. That was fun for a while, but when they shrank the group down to a skeleton crew I had the chance to go to Pixar to work in story, and that's where I am today."

Regarding the recent kerfuffle over a new SAM & MAX title which was in development at LucasArts but subsequently canceled, Purcell is relatively sanguine. "While at Pixar I was



consulting on SAM & MAX 2 after hours. I got word that it was canceled from the team but the subsequent fan backlash was an unexpected side effect. 30,000 people signed the online petition protesting the decision. I had no idea there had been that level of anticipation for the game."

Purcell questions whether his involvement in the game industry is completely behind him.

"Would I get back into games? Sure. The [SAM & MAX] license is back in my hands now, so we'll see what happens in the near future."

Since this interview was first published, Telltale Games has announced the development of a new SAM & MAX adventure, as well as a series of online comic strips drawn by Purcell.

"In the meantime," says Purcell, "when I'm not working at Pixar, I'm exploring other bizarre concepts, doing some painting,



and cobbling together material for my web site which will be called Spudvision.com."

*Originally published July 25, 2005
Simon Carless contributed to this article.*

DAVID CRANE

ACTIVISION CO-FOUNDER AND PITFALL! CREATOR



ACTIVISION CO-FOUNDER AND LEGENDARY GAME DESIGNER

David Crane was part of a group of four Atari programmers who, with the help of music industry executive Jim Levy, left the then-dominant global force in 1979 to form Activision. Publishing games for Atari's own console—the 2600—Activision became the world's first third-party video game publisher.

At Atari, Crane and his peers were often left uncredited in the games they designed and coded, but at Activision, the games took on a more novel approach—in both senses of the word. Activision games were treated as individual pieces of art, with the author's name and often photograph displayed prominently on the packaging.

Crane's early 1980s output at Activision includes several titles still talked about today, such as DRAGSTER, FREEWAY, GHOSTBUSTERS, LITTLE COMPUTER PEOPLE, and of course, the adventurous pioneer of the modern platformer, PITFALL! (and its subsequent sequel, subtitled LOST CAVERNS).

"Activision became the giant of the early 1980s by recognizing that a game is a creative product and requires a creative environment," Crane says. "Bruce Davis' biggest mistake was to treat video games as commodities rather than creative products. I only mention this because it explains why I could no longer associate with the company."

Bruce Davis took over as CEO of Activision in 1985 and is often the subject of discontent when discussing the publisher's fall from grace, which includes the closure of text adventure giant Infocom and a move to creating business applications, which ultimately resulted in Chapter 11 bankruptcy.

"After the management change, and with the working environment completely screwed up, I left the company," Crane says.

In 1985, Activision programmer Garry Kitchen spun off a game development group from Activision, working for them remotely.

"This was at the beginning of the downturn in the U.S. video game market," Crane explains, "and Activision was happy to reduce internal development costs by working with outside development houses." The company developed exclusively for

Activision for three years until, in 1988, Activision failed to renew its exclusive relationship with Kitchen's group, which subsequently adopted the name "Absolute Entertainment" and became a self-publisher.

At about this time, Crane was just finishing research work on a video game system for Hasbro Toys and was looking to get back into proper game design. "Garry [Kitchen] and I had become friends at Activision, so I joined him at Absolute," he says. "We developed NES games, SNES games, and even a few Atari 2600 games."

Among the titles Crane had a hand in at Absolute were SUPER SKATEBOARDIN', a number of early games based around the Simpsons license, and two of his own creations: A BOY AND HIS BLOB and DAVID CRANE'S AMAZING TENNIS.

"We had a lot of fun on the development side, but under the rule of Nintendo, the publishing side of the game business was really tough," Crane says. "Everybody knows that video game publishers went out of business right and left in the '80s and '90s, but is seems like very few understand why."

"The U.S. game business crashed because there were no quality controls on the games. Anyone with a PC and an EPROM burner could develop a game and try to sell it. Few of us will forget the overflowing bins of \$3 game cartridges in the stores—barrels of them—as stores tried to rid themselves of bad games they couldn't sell. Nintendo entered the business with a quality-control plan. If a publisher wanted to sell games for the NES, they had to sign an agreement that let Nintendo decide what games are good enough to sell. That seemed OK at the time since everybody believes that their games are great—what better protection for the best publishers? What few people knew was that this same agreement required that all manufacturing would be done by Nintendo and Nintendo alone," says Crane.

"A publisher would develop a game and fight with Nintendo to convince them that it was a good game. Then, if the game passed this step, the publisher had to order all their goods from Nintendo. These goods were, of course, marked up so that Nintendo would profit from the manufacturing (Nintendo

also required full payment in advance, so their profit was guaranteed]. Many months later, the games arrived from Japan and were delivered to retailers across the country.

"The big retailers like Toys R Us set the wholesale prices, and they set these prices lower and lower to maximize their profits. Nintendo set the cost of the manufactured goods, and those prices were set high enough for there to be plenty of profits—for Nintendo, that is. The publisher, who paid to create the game, was left with the tiny difference between the two."

"And if that isn't bad enough, before the big retailer would take your newest game, they expected to return for credit any older games on their shelves. Because, after all, the newer games are easier to sell. To make a small profit, a publisher had to predict exactly how many games would sell in the market—not to order too many since each return comes back at full price, nor to order too few because they need to sell enough to recoup their development costs. If their estimate was off by 10 percent either way, they were likely to lose money on the game. Absolute hell prey to this inventory gotcha around 1994. Nobody's crystal ball was that good."

"Garry Kitchen and I knew we enjoyed working together from Absolute, so after that we decided to join forces again," says Crane. "In 1995 the internet was just beginning to catch on. People were just beginning to surf in large numbers. We founded Skyworks to bring games to this new, wide audience."

Skyworks Technologies Inc. is a casual games developer and IGDA member. They are often credited with helping to form the concept of advergaming, or developing video game content to promote a product or brand.

"Garry and I have designed and marketed games for every video game system since the 1970s, and we decided to treat the internet as a new game system. Our expertise in making quality games for the early [small ROM] game systems would be invaluable in keeping game files small enough for modem download. We settled on Shockwave as a game design platform, a tool we had been using almost since its creation."

"But there was a challenge. These days, consumers spend billions of dollars online without a second thought. But if you remember 1995, not only were people afraid of using a credit card online, philosophically everything on the internet was supposed to be free! To address this challenge, we came up with a new business model. We partnered with large advertisers, showing them that putting branding in a game is a good way to reach their customers. The advertiser paid Skyworks to develop a game that contained their branding; the advertiser put the game on its web site; and the consumer played the game for free. This three-way partnership works so well that shortly after Skyworks pioneered the idea, someone in the press came up with a name for it. It is now called advergaming."

Skyworks, which describes itself as a developer of casual games for cell phones, console systems, and pay-to-play web-based games, has released titles such as TEXAS HOLD'EM and MONSTER TRUCKS for Game Boy Advance, but has concentrated chiefly on advergames, producing titles for BMW, Campbell Soup, GlaxoSmithKline, MTV, Pepsi, and Toyota.

"I still do game design and programming every day. Of course I am active in the business of games—I have almost 30 years of experience to draw upon—but gaming is my forte. I designed my first video game in 1977, and I don't know of anyone else from that era still actively programming."

"The longer I design games, the more my career resembles that of Charles Schulz. He drew 'Peanuts' for 50 years, almost right up to his death. I have 20 years to go." ☺

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EA. Such a nice working environment, such a relaxed attitude. During my induction, I was told it was fine to take some time out of the work day to stop and have fun. Perhaps I'd like to make a birthday card for a friend or challenge a colleague to a few laps of slot car racing.

OLD HABITS DIE HARD

A decade later and I was running a studio for a U.K. developer called Computer Artworks. The culture was much as it was in my first days at EA. There was work going on, but within a youth club atmosphere. I started to feel increasingly frustrated about the wasted time. I saw hundreds of pictures of cats in hats circulating the internal mail groups, and I know that for every mail sent to the group, 50 people were reading and being distracted by it. Similarly, people were browsing the web throughout the day. I walked around the office hearing the clicks of browsers being minimized.

Don't get me wrong—it wasn't an office full of slackers. There were plenty of people working hard and getting things done, and I worked with some talented people, but surely they could see the wasted time? Didn't it annoy them too?

I knew that before too long it would be crunch time and I'd be asking for late nights and sacrificed weekends. How can I give people a hard time when I'm asking for 70 hours of their week?

Milestones slipped, milestone payments were drawn out, and eventually the bank manager shouted "game over." We were the twenty-sixth U.K. developer to hit the wall that year and clearly something wasn't working.

THE NEED FOR CHANGE

From the ashes of our previous company we proposed a new type of development studio, but a studio with completely different working practices. We put a proposal to the staff: If you focus on work nine to five, we'll never ask for evenings or weekends.

Since a number of us had children, a guaranteed 40-hour week was an enticing proposition, but in order to ensure focus, we had to put some policies in place.

Start at 9 a.m. sharp. Historically, 10 a.m. was the start time, but in reality people would get in just after 10, make coffee, catch up on email, and start real work at 11. Since lunch is at 1 p.m., half the morning was being wasted.

Now, we require everyone to be at 9 a.m. exactly and expect work to start at five after. No exceptions.

Reduced email. We actively discourage email. Too many of us had been constantly interrupted by the Outlook envelope and had forgotten that email is rarely the best form of communication. Additionally, we told everyone not to use their work email address for personal mail. They'd have to get used to Hotmail.

Limited internet. We had the firewall block all internet connections except for about a dozen work-related sites. It also blocks any MSN-type chat clients.

Because the internet really can be a useful tool, we set up two terminals that allow access at any time.

No recreational games. A controversial policy in a games company, no doubt. Sure, we'd let people research relevant games, but how much value are those noisy COUNTER-STRIKE tournaments?

Out at 5 p.m. This isn't just a selling point, it's a policy. We don't want people hanging around at work evenings or weekends for two reasons. First, we want the office to be a place that's exclusively for working. Second, we believe better work is done when you step away from the screen and have a life outside.

TRUE TO ITS NAME

Relentless Software was formed with this methodology, and the company culture felt different from the off. People are focused on work from nine, never work much past five, and never have to work the weekend. We get to do the school run—we get to have a life outside of work. This creates additional motivation, which means that despite a shorter working day, we've been painlessly hitting milestones and over-delivering on quality.

We're now two years old, have shipped 15 SKUs, and still never work evenings or weekends—even in crunch time. The policies we set have had more of an effect than I could have hoped.

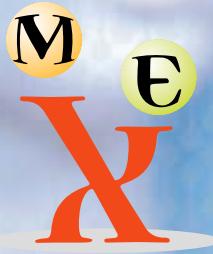
POINTING FINGERS

I continue to see people deplored their working conditions and pointing the finger at the employer. It's true that employers are usually due a large part of the blame, but I think the biggest problem is that employers and employees alike are still working the same way they did 20 years ago. It shouldn't be surprising that the most productive day is one that's held between nine and five.

Our working practices have been described as totalitarian. Our response is that everyone goes home at five and can do whatever they please. Provided we keep up our end of the bargain, that doesn't sound unreasonable. And a nice side effect is that since quality and productivity is high, everyone has confidence that they'll still have a job next month.

Your mileage may vary. It's much easier to set a work culture in a new company than it is to try and change a culture in an existing company, and unless you're the boss, you don't get to change everything you'd like anyway. All I can say is that things worked a lot better for us when we stopped working silly hours and started treating video game development like a proper job. After all, most of the world works this way and it seems to work for them. ☺

DAVID AMOR is the creative director at Relentless Software, a developer making games for Sony Computer Entertainment Europe. Relentless' latest game, *Buzz!: The MUSIC QUIZ*, was released across Europe in October. Email David at darmor@gdmag.com.



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EVOLVE YOUR HIERARCHY

Refactoring game entities with components

UNTIL RECENTLY, GAME PROGRAMMERS consistently used a deep class hierarchy to represent game entities. The tide is beginning to shift from this use of deep hierarchies to a variety of methods that compose a game entity object as an aggregation of components.

This article explains what this means and explores some of the benefits and practical considerations of such an approach. I will describe my personal experience in implementing this system on a large code base, including how to sell the idea to other programmers and management.

GAME ENTITIES

Different games have different requirements as to what's needed in a game entity, but in most titles the concept of a game entity is similar. A game entity is some object that exists in the game world. Usually the object is visible to the player, and usually it can move around.

Some examples of an entity include a missile, car, tank, grenade, gun, hero, pedestrian, alien, jetpack, med kit, rock, and so on. Entities can usually do various things, such as run a script, move, react as a rigid body, emit particles, play located audio, be picked up by the player, be worn by the player, explode, react to magnets, be targeted by the player, follow a path, or animate.

TRADITIONAL HIERARCHIES

The traditional way of representing a set of game entities is to perform an object-oriented decomposition of the set we want to represent. This usually starts out with good intentions, but is frequently modified as the game development

progresses, particularly if a game engine is reused for a different game. We usually end up with something like Figure 1, but with a far greater number of nodes in the class hierarchy.

As development progresses, we usually need to add various points of functionality to the entities. The objects must either encapsulate the functionality themselves or be derived from an object that includes the functionality. Often, the functionality is added to the class hierarchy at some level near the root, such as the CEntity class, which carries the benefit of the functionality being available to all derived classes, but has the downside of the associated overhead also being carried by those classes.

Even fairly simple objects such as rocks or grenades can end up with a large amount of additional functionality (and associated member variables, and possibly unnecessary execution of member functions). Often, the traditional game object hierarchy ends up creating the type of object known as "the blob." The blob is a classic anti-pattern, which manifests as a huge single class (or a specific branch of a class hierarchy) with a large amount of complex interwoven functionality.

While the blob anti-pattern often shows up near the root of the object hierarchy, it will also show up in leaf nodes. The most likely candidate for this is the class representing the player character. Since the game is usually programmed around a single character, the object representing that character often has a very large amount of functionality. Frequently, this is implemented as a large number of member functions in a class such as CPlayer.

The result of implementing functionality near the root of the hierarchy is an overburdening of the leaf objects with unneeded functionality. However, the opposite method of implementing the functionality in the leaf nodes can also have unfortunate consequences. Functionality now becomes compartmentalized so that only the objects specifically programmed

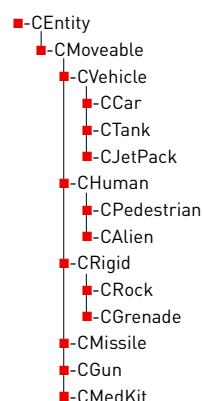


FIGURE 1 A typical game entity hierarchy.

for that particular functionality can use it. Programmers often duplicate code to mirror functionality already implemented in a different object. Eventually, messy refactoring is required and you have to restructure the class hierarchy to move and combine functionality.

Take for example the functionality of having an object react under physics as a rigid body. Not every object needs to be able to do this. As you can see in Figure 1, we just have the CRock and the CGrenade classes derived from CRigid. What happens when we want to apply this functionality to the vehicles? You have to move the CRigid class farther up the hierarchy, making it more and more like the root-heavy blob pattern we saw before, with all the functionality bunched in a narrow chain of classes from which most other entity classes are derived.

AN AGGREGATION OF COMPONENTS

An approach that is gaining more acceptance among current game developers is to separate the functionality into individual components that are mostly independent of one another. The traditional object hierarchy is dispensed

MICK WEST was a co-founder of Neversoft Entertainment. He's been in the game industry for 17 years and currently works as a technical consultant. Email him at mwest@gdmag.com.

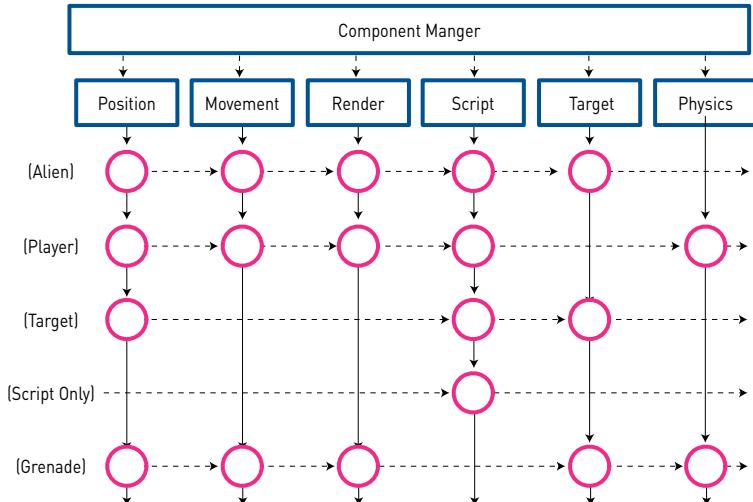


FIGURE 2 Object composition using components is viewed here as a grid.

with, and an object is now created as an aggregation (a collection) of independent components.

Each object now only has the functionality that it needs. Any distinct new functionality is implemented by adding a component. A system of forming an object from aggregating components can be implemented in one of three ways, which may be viewed as separate stages in moving from a blob object hierarchy to a composite object.

ORGANIZED BLOB

A common way of refactoring a blob object is to break out the functionality of that object into sub-objects, which are then referenced by the first object. The blob object, eventually, can mostly be replaced by a series of pointers to other objects, and the blob's member functions become interface functions for the functions of those sub-objects.

This solution may actually be a rational one if the amount of functionality in your game objects is reasonably small or if time is limited. You can implement arbitrary object aggregation simply by allowing some of the sub-objects to be absent (by having a NULL pointer to them). Assuming there are not too many sub-objects, then you have the advantage of working with lightweight pseudo-composite objects without

having to implement a framework for managing the components of that object.

The downside? We still essentially have a blob. All the functionality is still encapsulated in one large object. It's unlikely you will fully factor the blob into purely sub-objects, so you will still be left with some significant overhead, which will weigh down your lightweight objects. Plus, you still have the overhead of constantly checking all the NULL pointers to see if they need updating.

COMPONENT CONTAINER

The next stage is to factor out each of the components (the "sub-objects" in the previous example) into objects that share a common base class, so we can store a list of components inside an object.

This solution is an intermediate one, as we still have the root object that represents the game entity. However, it may be a reasonable solution, or indeed the only practical one, if a large part of the code base requires this notion of a game object as a concrete object.

Your game object then becomes an interface object that acts as a bridge between the legacy code in your game and the new system of composite objects. As time permits, you will eventually remove the notion of the game entity being a monolithic object and instead address the object more directly via its components. In time, you may be able to transition to a pure aggregation.

PURE AGGREGATION

In this final arrangement, an object is simply the sum of its parts. Figure 2 shows a scheme where each game entity comprises a collection of components. There is no "game entity object" as such. Each column in the diagram represents a list of identical components; each row can be thought of as representing an object. The components themselves can

be treated as being independent of the objects they make up.

EMPIRICAL EVIDENCE AND SKATEBOARDS

I first implemented a system of object composition from components when working at Neversoft on the *TONY HAWK* series of games. Our game object system had developed over the course of three successive games until we had a game object hierarchy that resembled the blob anti-pattern I described earlier. It suffered from all the same problems. The objects tended to be heavyweights. Objects had unnecessary data and functionality. Sometimes the unnecessary functionality slowed down the game. Functionality was sometimes duplicated in different branches of the tree.

I had heard about this new-fangled component-based objects system on the *sweng-gameDev* mailing list and decided it sounded like a neat idea. I set to reorganizing the code base, and two years later it was done.

Why so long? Well first, we were churning out *TONY HAWK* games at the rate of one per year, so there was little time between games to devote to refactoring. Second, I miscalculated the scale of the problem. A three-year old code base contains a lot of code. Much of that code became somewhat inflexible over the years. Since the code relied on the game objects being game objects, and very particular game objects at that, it proved to be a lot of work to make everything work as components.

The first problem I encountered was in trying to explain the system to other programmers. If you're not particularly familiar with the idea of object composition and aggregation, it can strike you as pointless, needlessly complex, and unnecessary extra work. Programmers who have worked with the traditional system of object hierarchies for many years become very used to working that way. They even become very good at working that way, maneuvering around problems as they arise.

Selling the idea to management is also difficult. You need to be able to explain in plain words exactly how this methodology is going to help get the game done faster, something along the lines of: "Whenever

we add new stuff to the game now, it takes a long time to do it, and there are a lot of bugs. If we do this new component object thing, it will let us add new stuff a lot quicker and with fewer bugs."

My approach was to introduce it in a stealth manner. I first discussed the idea with a couple of programmers individually, and eventually convinced them it was a good idea. I then implemented the basic framework for generic components and implemented one small aspect of game object functionality as a component. I then presented it to the rest of the programmers. There was some confusion and resistance, but since it was already implemented and working, there wasn't much argument.

SLOW PROGRESS

Once the framework was established, the conversion from static hierarchy to object composition happened slowly. It is thankless work, since you spend hours and days refactoring code into

something that seems functionally no different to the code it replaces. In addition, we were doing this while still implementing new features for the next iteration of the game.

At an early point, we hit the problem of refactoring our largest class, the skater class. Since it contained a vast amount of functionality, it was almost impossible to refactor a piece at a time. In addition, it could not really be refactored until the other object systems in the game conformed to the component way of doing things. These in turn could not be cleanly refactored as components unless the skater was also a component.

Our solution was to create a "blob component." This was a single huge component, which encapsulated much of the functionality of the skater class. A few other blob components were required in other places, and we eventually shoehorned the entire object system into a collection of components. Once this

was in place, the blob components could gradually be refactored into more atomic components.

RESULTS

The first results of this refactoring were barely tangible, but over time the code became cleaner and easier to maintain as functionality was encapsulated in discrete components. Programmers began to create new types of object in less time simply by combining a few components and adding a new one.

We created a system of data-driven object creation so that entirely new types of objects could be created by the designers. This proved invaluable in the speedy creation and configuration of new types of objects.

The programmers came [at different rates] to embrace the component system and became very adept at adding new functionality via components. The common interface and the strict encapsulation led

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to a reduction in bugs and resulted in code that was easier to read, maintain, and reuse.

IMPLEMENTATION, PAYOFF

Giving each component a common interface means deriving from a base class with virtual functions. This introduces some additional overhead. Don't let this turn you against the idea, as the additional overhead is small compared to the savings due to simplification of objects.

Since each component has a common interface, it's very easy to add additional

debug member functions to each component. That made it a relatively simple matter to add an object inspector that could dump the contents of a composite object's components in a human readable manner. Later, we evolved this action into a sophisticated remote debugging tool that was always up to date with all possible types of game object, which would have been very tiresome to implement and maintain with the traditional hierarchy.

Ideally, components should not know about each other. However, in a practical world there are always going to be dependencies between specific components. Performance issues also dictate that components should be able to quickly access other components. Initially, we had all component references going through the component manager, but when it started using more than five percent of our CPU time, we allowed the components to store pointers to one another and call member functions in other components directly.

The order of composition of the components in an object can be important. In our initial system, we stored the components as a list inside a container object. Each component had an update function, which was called as we iterated over the list of components for each object.

Since the object creation was data-driven, it could have created problems if the list of components was in an unexpected order. If one object updated physics before animation, and the other updated animation before physics, then they might get out of sync with each other. Dependencies like this one need to be identified, and then enforced in code.

Moving from blob-style object hierarchies to composite objects made from a collection of components was one of the best decisions I made. The initial results were disappointing as it took a long time to refactor existing code. However, the results were well worth it, with lightweight, flexible, robust, and reusable code. ☺

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» PIXEL PUSHER

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THIS MONTH, WITH THE GAME DEVELOPERS

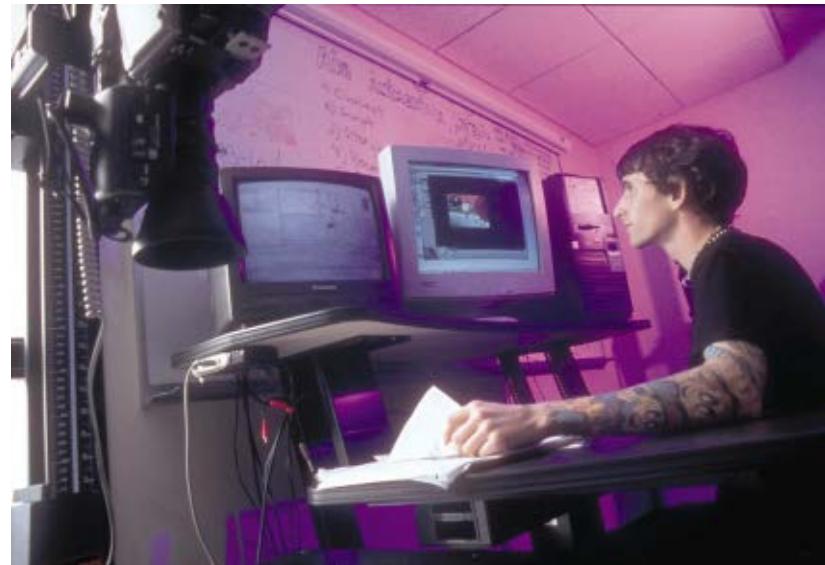
Conference almost upon us, is a good time to take a break from technical and artistic considerations and think a little bit about the "job" side of our jobs.

This time of year, more than a few of us are mulling over the state of our careers. Even if you're happily employed, there's nothing like a stroll through the meat market in the San Jose Convention Center to get you thinking about a change. Whether it's a new game, a new city, or a new standard of living you're after, anything seems possible when the mating season is in full cry. So I'd like to devote this column to a short consideration of the changing meaning of being a game artist.

THIS TIME, IT'S PERSONAL

I have to start off by confessing, "This time, it's personal." I'm writing this exactly one week before departing my current position for an exciting, unpredictable, and slightly terrifying new life as a founding partner of a new studio. There's nothing like the prospect of a year of long days, frequent flyer miles, and a big fat goose egg for a salary to really concentrate the mind, so you can bet I've been thinking very hard about "the changing meaning of being a game artist."

It's certainly about to change for me, but I'm convinced that I'm not the only one. The industry is in the early stages of



a long-term transformation that will alter the basic texture of our working lives.

Behind the excitement (and the terror), the transition has been especially poignant for me. My current job has been great. My company, my project, and my team are all exceptional, and it's been extremely hard to say goodbye. Leaving a project just when all of the spadework I had put in is starting to bear fruit is also very hard. I take a certain degree of comfort, though, in the fact that I've had a chance to live out the central myth of the game industry.

What defines us as a group, more than hovering around the water cooler telling each other about the game we'd make if only we were in charge? Who can forget those legendary days when any six kids who had shipped an expansion pack for QUAKE could talk a publisher out of a wheelbarrow full of cash? The dream of setting up your own shop is bred right down into the bones of the business.

'RESPECTABLE' BUSINESS STANDARDS

Of course, things aren't that simple any more. As team sizes get bigger and publishers bring more and more development in-house, the game business is losing a lot of its Wild West flavor. For one thing, wheelbarrows full of cash aren't quite as easy to come by as they used to be. It's probably inevitable—plenty of other businesses that once buzzed with anarchic entrepreneurial energy have grown up to become well-funded, well-run, respectable, and dull. The same may very well happen to us. There may come a day when starting a game company out of your garage might sound laughable. There may come a day when you can't get someone to look at your reel unless you have credentials from an approved art school. There may come a day when the chance of seeing a royalty check, much less of owning a slice of your own company, is a perk reserved for the managerial elite. There may even come a day when you're

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The game industry is on the verge of growing up, but what will a "respectable" industry look like from the standpoint of a working artist?

WHEN THE GLASS IS HALF FULL

Many of us break out in hives at the thought of corporatization. However, we shouldn't assume that the changes are all for the worst. Stability may be dull if you're nostalgic for the romance of your startup days, but it has its pluses—like a regular paycheck, medical benefits, and the likelihood of your work being funded to completion. The deep pockets of big corporations will buffer the economic uncertainties that batter smaller developers.

My (soon to be former) employer was just purchased by Sony, and it looks like a great deal all around: a good value for the publisher and a valuable safety net for the studio. If nothing else, the economic interests of publishers are exactly aligned with those of in-house developers. It's nice when people with tens of millions in the bank really don't want to see you fail.

Maturity brings with it professionalism, a word not typically associated with artists. But professionalism doesn't have to mean "showing up to work in suit," or "being a drone." It can simply mean "having standards." A profession isn't just a job; it's a shared set of baseline skills and knowledge.

Our perennial rivals in Hollywood have a very sophisticated network of professional associations for everyone in the business, from sound editors to snake wranglers. A Hollywood director can assemble a team of people who have never worked together before and feel perfectly confident that they will communicate efficiently and start collaborating immediately because they're all plugged into an industrywide system of professional standards, training, and best practices.

With game developers, by contrast,



almost every studio is an isolated little fiefdom with its own customs, habits, and language, which every newcomer has to slowly acquire. Local color may be charming, but we would all benefit from some industrywide clarity about what to expect when a new hire walks in the door. Employers might have a better idea of what they were really getting, and we'd certainly be better off knowing that our hard-won experience wouldn't get flushed down the graphics pipeline every time we changed jobs.

The last, and potentially most important thing about consolidation in the business is that big companies, if they are serious about their people, can offer a working artist a career ladder with more than three or four rungs.

As it stands, plenty of veteran artists in our business have reached their top title and peak earning power in their 30s. All too frequently, they're out of the business by their mid 40s, since they have nothing to look forward to in career terms. There's not a lot of headroom in a studio of 30 or 40 people.

In a bigger company, at least there's the possibility of increased pay for valued vets who don't want to be

managers. You can also find more prestige positions in a larger company, like working in a divisional cinema group or a research and development demo team. If you prefer to go the management route, well, there will be a lot more managing to do in a company of hundreds than in one of dozens. In a bigger company you have the potential for a more varied and interesting career.

WHEN THE GLASS IS HALF EMPTY

Of course, there's no guarantee that all these potential benefits will materialize. For many industries, consolidation brings stratification of income and opportunity. The recent spate of unrest at big studios suggests some companies are considering the "Wall Street" model of recruiting: Talented kids are tantalized by the prospect of huge riches—but nine out of every 10 of them are burned out and discarded before they reach the pot of gold at the end of the rainbow. Of course Wall Street can do this because the rewards for the chosen few are huge; it might not work in our pay scale. But if the lottery system does become the



dominant model, it will make it very tough for the average working artist to build a life around a job in games.

Since we're looking at depressing possibilities, we can also question whether big companies really will provide a more stable career path over the long haul. Big companies don't have to worry about making payroll from month to month, but they can also liquidate jobs with frightening speed. It only takes a hiccup from the right Wall Street analyst to make an earthquake in your cubicle.

For all the economic uncertainty of working at a small firm, it's always nice to know the name of the person who'll have to fire you. And of course, it's much easier to outsource jobs by the thousands than by the dozens.

CORPORATE PINCH

The real future is probably somewhere between utopia and dystopia. I don't think the economic situation is going to be completely dire. Game development is still very, very hard, and our skills are still pretty rare. Companies that try to skimp on people won't win in the end. But even if the economics aren't that punishing, a big-business game industry will still be a very different kind of place to work. You don't have to think that "corporate" is some kind of dirty word to know that a more industrial-scale games business is going to have a different creative focus and a different emotional tone.

On the creative side, the increasing size of teams and budgets is almost certainly going to lead to fewer and fewer of us getting the chance to build new IP. It isn't corporate zombiehood that makes you a bit cautious when you're writing out a check for \$20 million or \$30 million, it's simply the instinct for self preservation. Safe properties like movie licenses, marketing tie-ins, and sequels are going to be the dominant mode for the foreseeable future.

When you're really big, you leave the quirky, offbeat niche markets for the artistically pure and the chronically under-funded, so don't expect the mainstream of the games business to be a very daring place in the next five years. Creativity won't disappear, but it will have to play the role of a mammal in a land of dinosaurs: It will continue to thrive, just in an underfoot kind of way.

IN THE ARMY NOW

Now, I may be a sentimentalist but I think the really important thing that will happen as the industry grows up isn't financial or even artistic—it's emotional. The classic video game industry lifestyle reproduces, in a very tame way, the same kinds of pressures that make soldiers, police, and firefighters so clannish.

We spend a huge amount of time with our teammates (more than we do with our families). We rely on our teammates through deadline stress, sleep deprivation, horrible late-night takeout, and last minute fire drills. In short, working as a game artist tends to compress people into very tight knots.

In the Army, it's said that nobody fights for ideals, a few people fight for their country, but everybody fights for their squadmates. In the game industry, we work first and foremost to impress, inspire, or rescue our teams. Companies, especially big ones, are a distant abstraction, but the folks jamming with you on that E3 demo are important, especially at three in the morning.

If companies get bigger, teams will form and reform kaleidoscopically. The long-term bonds you develop from working for three years together on the same project will become much rarer, and one suspects that people will be a

bit less eager to make sacrifices for those strangers in the next cube.

For artists especially, there's another reason why teams are so important. Games, even more than movies, are a collective rather than an individual art form. Steven Spielberg may not act, design, or shoot every moment in his films, but he can still foresee with a fair degree of precision how each scene will look and sound. In making video games, by contrast, it's very tough to be an auteur. Part of the cause is our collective immaturity, but some of it is also our collective democracy. We're much less formal, hierarchical, and regimented than older creative businesses.

This, more than anything else, explains why game artists are so invested in our teams. Deep in our bones, we know that our own success is impossible without our teammates, which is either stirring or frightening, depending on how you choose to look at it. It's hard to see how the democratic impulse can survive when 50 or 75 or 150 artists work on a project. Pyramidal command-and-control will become far more necessary; fewer of us will have a real influence on the shape of our projects, and more of us will just have to do what we're told.

SENSE AND SENSIBILITY

Is the future really all bleak? Not at all. We'll always be the kind of business in which it's socially permissible to mention orcs in mixed company. Almost as important, a growing industry means there will be more room for alternative business models alongside the corporate giants. Companies like Wideload Games or Manifesto Games or PopCap may never be the mainstream of the business, but even a small slice of a \$30 billion industry can be very rewarding.

Creatively, big companies and indie sensibility are often mutually dependent, rather than pure opposites. If I thought the only way to succeed in games was to crush spirits, pick pockets, and crank out trash, I sure as hell wouldn't be involved in starting a game company.

Game art has always been the art of making something great under incredible constraints and impossible conditions. Now that I think of it, maybe things aren't changing so much after all. ☺

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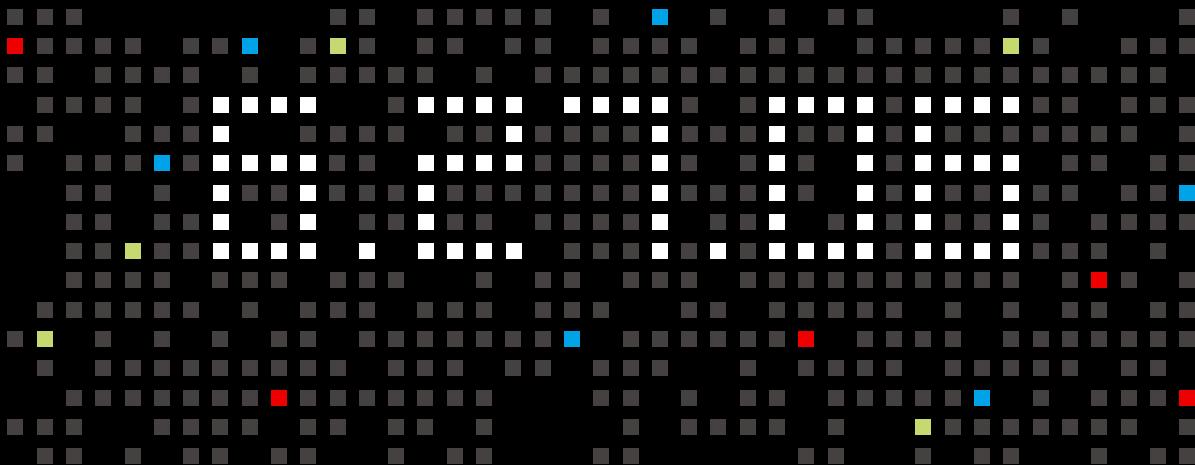
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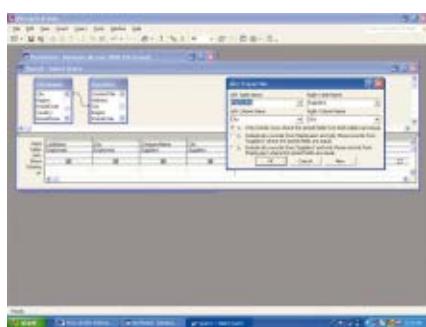
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DATABASIC IDEAS

Part I: Outsourcing production

FOR THOSE EMBROILED IN THE ART OF our craft, organization, critical thinking, and logic are our enemies. However, as with any industry, if you wish to make your craft your source of income, organizational skills become a necessity. For those of us in the still-young game development field, it's good to take cues from different industries, especially in terms of

organizational practices. Businesses have risen and fallen by the thousands depending on their ability to change and use data to their greatest advantage. So let's break down this



Using a database program such as Microsoft Access can streamline your scheduling process.

organizational mumbo jumbo by discussing a tool that few audio departments at game companies use to their fullest potential: the database, which simply put is an organized way of storing and retrieving data. Yes, yes, you all knew that, but sometimes we need to be reminded. It's true that many game companies use databases, but just like that mixer on your audio bloke's desk, do you use it to its fullest potential to maximize productivity?

THE CASE FOR THE 'BASE
In a MMORPG, databases are the lifeblood of the game itself when managing the customer base. They are also used in AI systems—various forms of databases

are used to control non-player characters. In terms of audio, we use and discard databases of sounds for each project. While I plan to discuss proper usage of in-game sound databases later (that's next in this two-part series), in this particular article I'll talk about

production sources. Most people keep composers, studios, casting directors, actors, and the like in their head when getting people to produce assets. However, when you work in a studio that's responsible for multiple titles each year, having a database of sources and keeping it up to date is incredibly important.

Why use a database and not a spreadsheet? Spreadsheets are the "one size fits all" solution used by quite a few game developers out there, but they are to managing data what AOL is to the internet—easy to use, but not very flexible. Databases allow you to customize whatever you like, however you like. If you want a lot of data that can be accessed via the web, viewed as a spreadsheet, and has the ability to make entries using customized fields, get a database.

CHOOSE OR LOSE

There's an awful lot of database software out there. The three main programs in my mind are Access, Filemaker, and MySQL. The previous two are commercial and non-open source, whereas MySQL is open source. If you want a turnkey solution that offers a lot of initial features but little flexibility for changing the architecture (in terms of customization with proprietary software), go with Access or Filemaker. For total control but a bit more work under the hood, get MySQL.

Here are some categories that will make your life easier as you build an outsourcing production database.

Contact info/asset type. Music, SFX, voice over, or all three? You might have a favorite composer for each genre, but what was the name of that guy or girl who showed you the killer demo at GDC '03?

Keep the names, specialties, and contact info of the sources that both you and your producers like so that you're all on the same page when the next project comes along.

Fee. People do change their fees, and some charge less than others. Some are also more negotiable than others based on the individual project. Having this information close at hand is useful when drawing up contracts.

Legal. Was a special contract made for this production contact? Were there special considerations? Attaching their contract is a good idea so it can be drawn up by the production and legal departments.

Licensing. The criteria here are similar to legal. Usually this will apply to a band or a celebrity talent for voice over.

Production time. How long does it take a given composer to do a two-minute piece? How much time did it take to get a bid from the voice over studio on the last project? This information can be invaluable when planning budgets.

Samples. Rather than say "this person is good," actually show it. A database makes it simple to link fields to sample files that can be retrieved and accessed on the spot for faster decision making.

Additional notes. Something that can't necessarily be quantified but definitely helps in each entry is how easy a given person is to work with. Any hiccups or discrepancies can be reported here so you can keep track of how well each project goes with each contractor.

ACE OF DATABASE

Having this information easily accessible can trim weeks off your estimates for scheduling, and save time when getting bids and contracts. The real secret to success here is having the discipline to create and maintain such a database. So remember when you sit down to figure out who will do music for your next project, having a database may be a bit of extra work at first, but with the time it saves you'll thank me for it. ☺

ALEXANDER BRANDON has been involved with game audio since 1994 and is currently the audio manager at Midway in San Diego, Calif. You can email him at abrandon@gdmag.com.



NOAH FALSTEIN

» GAME SHUI

THE JUDO RULE

GAME DESIGNER AND SCIENCE FICTION
writer Greg Costikyan gave us this rule: Design to the medium's strengths instead of struggling with its limitations (see "Have Cell Phone, Will Play," April 2004 for a thorough discussion).

Costikyan proposed it as a rule for cell phone games, but it transcends as a good general purpose rule that's particularly important to follow when forging into untested territory and designing a game for a new platform or entirely new medium. Many of the recent Nintendo DS games have been successful in part because they use voice recognition or the stylus, and some—like NINTENDOGS or TRAUMA CENTER: UNDER THE KNIFE—would have been very hard to implement well without it.

But there's a rarer yet still useful rule that can trump Greg's. I call it the Judo Rule.

THE RULE

Turn your limitations into strengths.

When you find yourself constrained by a difficult circumstance or combination of limitations in design, look for a solution that turns those very limitations into a fun solution. Try to make the limitations work in your favor, not against you.

THE DOMAIN

The domain for this rule is all game design problems whose existing limitations strongly constrain you as a designer.

This rule is hard to implement, and a good solution is not always available—but when there is one, it's often particularly good indeed. Accordingly, if it doesn't produce useful results after some good, concerted brainstorming

and effort, it would be wise to can it and pursue some other method instead.

EXAMPLES

One of my favorite examples of this rule is an old one: the basic concept behind the Insult Swordfighting sub-game in THE SECRET OF MONKEY ISLAND. MONKEY ISLAND was an adventure game from LucasArts

designed by Ron Gilbert, who had recently worked with David Fox and me on the INDIANA JONES AND THE LAST CRUSADE adventure game.

For the INDIANA JONES game, we had needed a mini boxing game to replicate a scene from the movie (which was cut in the box office version). I had greatly enjoyed SID MEIER'S PIRATES, which had a simple swordfighting interface. The player could strike high, medium, or low, and advance or retreat; so I stole ... that is, I lovingly paid tribute to Meier's interface by using it for Indy's boxing match. Somehow I forgot to mention where I got the idea from in the first place.

After the game shipped, Gilbert had moved on to a game about pirates—the first MONKEY ISLAND game. One day he stopped by my office and casually mentioned that he was thinking of using the Indy boxing interface in his game, saying, "It might make a good pirate swordfighting interface."

"I don't think that's such a good idea." I said, improvising fast. "This is a comedy game, and that's not very funny." It was a pretty lame excuse, but my colleague seemed willing to give me the benefit of the doubt. I found myself desperately searching for an alternative approach so I wouldn't have to admit my "loving tribute."

How can you make a swordfight funny? It was a tense moment. I've since learned that high pressure and difficult constraints can spur creativity. And then I thought of the classic swordfight in the movie and book *The Princess Bride*.

In *The Princess Bride*, and indeed in a



The design of a swordfighting feature depends on what you want it to accomplish.

lot of old pirate classics going back to Errol Flynn, the sword wielders' physical dexterity ran a distant second to their skills with insults and rejoinders.

It was decided. The MONKEY ISLAND fighting interface settled on matching insults to appropriate, funny responses as a core mechanism. We had turned a difficult limitation ("swordfighting isn't funny") into an inspiration for what proved to be one of the popular features of the game. And I had kept my own pirating secret. That is, until now.

TO INFINITY AND BEYOND!

There are other great examples of this rule. The YOU DON'T KNOW JACK series took a really tough constraint—how do you create an entertaining game-show style experience without expensive animation or video?—and turned it into a very popular set of games using only voice and very simple text animation, all made on a small budget. WARIOWARE, INC. for Game Boy Advance took what seemed to be an impossible limitation—four-second long mini-games with a single-button press interface—and turned it into a very creative title.

In the movie industry, Pixar did much the same thing. Its early computer graphics weren't up to the challenge of creating realistic humans, but instead of trying anyway like the expensive *Final Fantasy* movie, Pixar turned to depicting toys, bugs, and monsters, setting box-office records for its efforts.

The Judo Rule doesn't always work, but when it does, it can pay off handsomely! ☺

NOAH FALSTEIN has been a professional game developer since 1980. 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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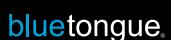
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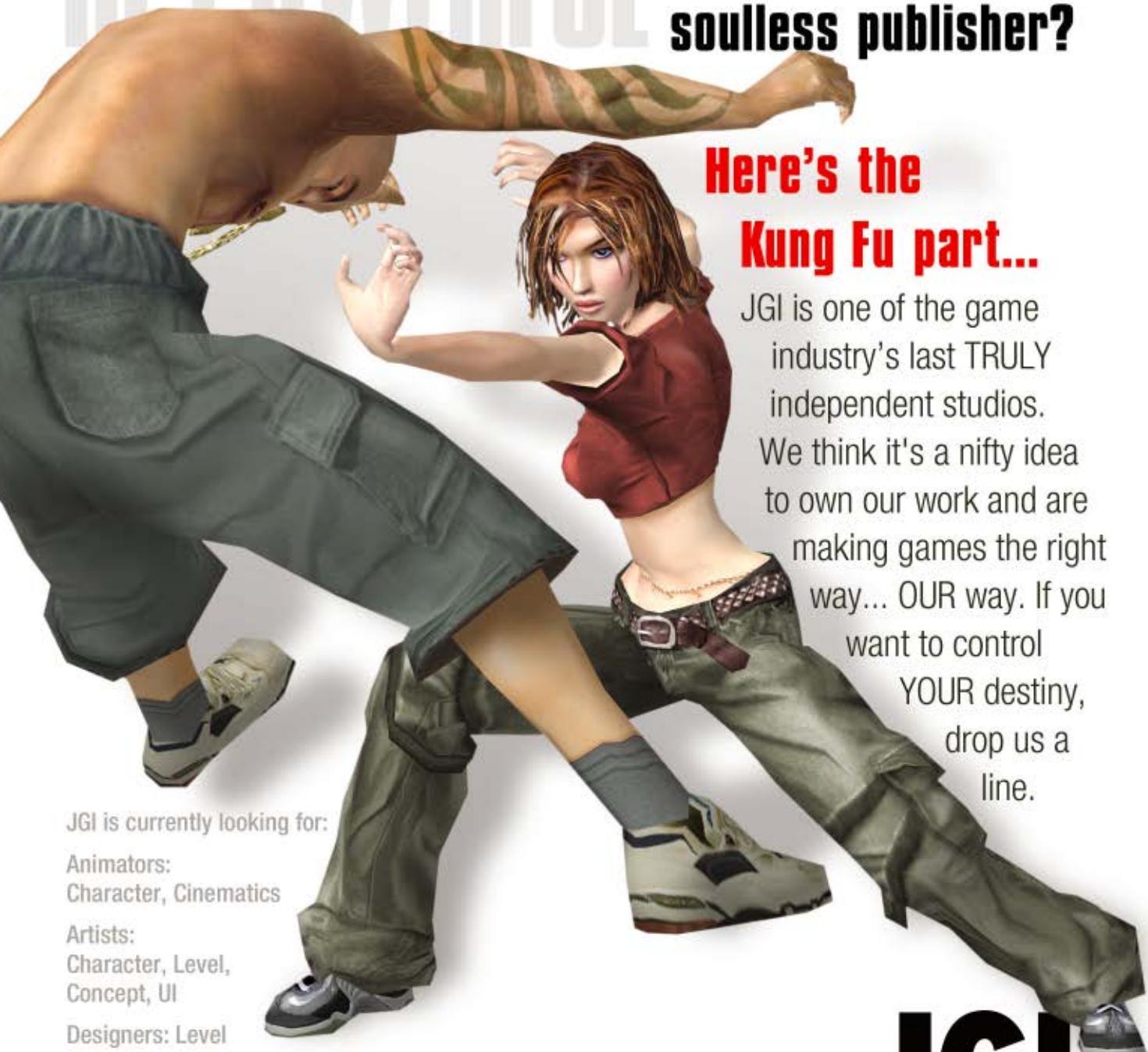
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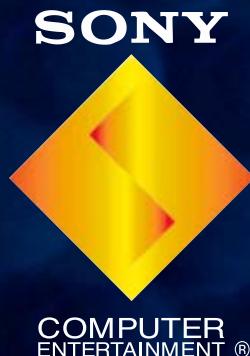
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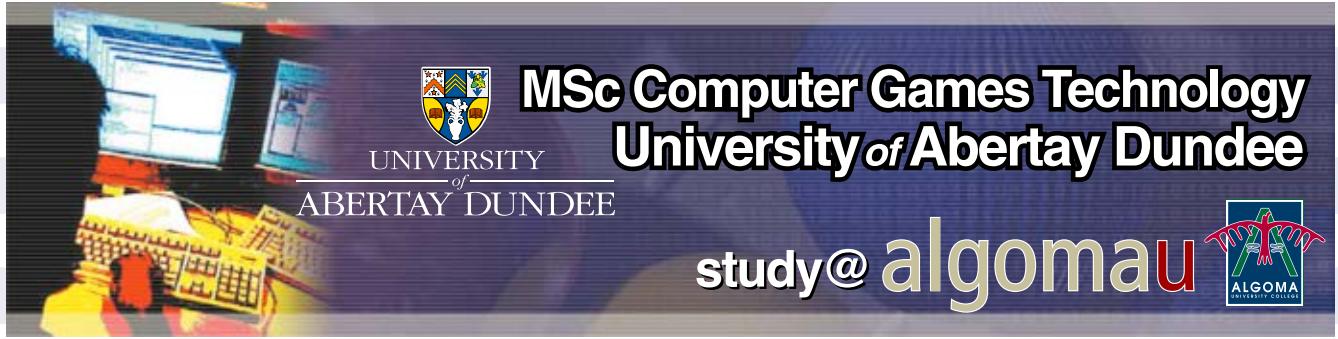
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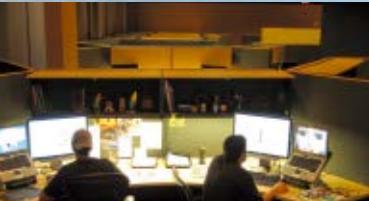
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The Copperhead mouse's blue glowing body was designed to be both ergonomic and ambidexterous.

CONTINUED FROM PG 8

Monte Carlo SS, the Copperhead would feel more at home plugged into an Alienware system than a beige box.

All faux carbon-fiber and softly pulsating blue LEDs, this mouse has the same sex-appeal as a pulse rifle from UNREAL TOURNAMENT. Unfortunately, Razer spent more time and effort on the mouse body than the design of the cord, which has the cheap plastic, non-flexible feel of an inexpensive phone cord. The company calls it "non-tangle," but I found it to just be cheap looking. Aside from the ugly cord, the Razer Copperhead is one beautiful peripheral.

After the initial fight with the impenetrable bubble pack (why do they do that?), I removed the mouse and software and had no trouble at all installing it. The drivers installed quickly and with no trouble on both Windows 2000 Professional and on Windows XP Professional. (Mac OS X is not supported.)

I had to skip over to the web site to figure out what to do with the settings, as I couldn't find a help file. The support section of the site was somewhat lacking, containing only a handful of issues and nowhere to direct new questions. The contact page contained a single email address, which seems to be the catchall for any web inquiries. I was glad to have had a trouble-free installation.

TWITCH ANALYSIS

Although it's really great for twitching through HALF-LIFE 2 or DOOM 3, the Razer Copperhead actually made my time in Photoshop and Maya

a little less entertaining than my standby, albeit chunky, Intellimouse Optical.

The Copperhead's pointer speed is infinitely adjustable and extremely sensitive, to the point of being too twitchy for accurate modeling and pixel pushing. In addition to the unit being so sensitive you can almost see your heartbeat on the pointer, the accessory buttons on the left and right sides are a bit out of reach for my big mits. Although there's a function in the driver that allows what they call "on-the-fly sensitivity" that calibrates the DPI of the mouse to your usage patterns, I still found it to be too spastic to use for modeling and image processing.

Turning down the pointer speed helped a bit, but I found that what I was trying to do after a few hours of tweaking and using it was to approximate my older Intellimouse ... which cost a mere 25 bucks.

In conclusion, if I were a dedicated first-person shooter aficionado, I would most certainly purchase this unit to increase my deadly skills. As a professional artist and tech geek, I found it to be less useful in my daily production pipeline than cheaper mice. ☺

SPENCER LINDSAY is a freelance effects artist who works from his tree-covered lair in Monterey, Calif. His work can be found at www.lindsaydigital.com. Email him at slindsay@gdmag.com.

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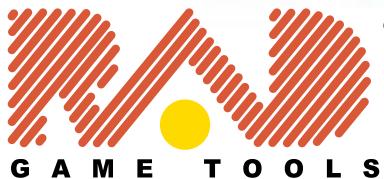
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