John Carmack Archive - Interviews

August 2, 2008

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Chapter 1

John Carmack Interview

This interview was conducted by Bone for Blues News on Jan 08, 1997.

http://www.bluesnews.com/cgi-bin/articles.pl?show=11

Interview

Prologue

I originally sent my questions to American McGee with the firm intention of wrapping an article around them. American, it seems, was too busy to do interviews at this moment, so I risked bothering John Carmack with the same questions. I did not do this lightly, taking about 5 days to consider whether he should be bothered or not. However, I thought my questions were sufficiently well thought out enough that John might actually WANT to answer them. Boy was I surprised when I looked in my email this morning.

I originally thought I'd get a sentence or two in response to my questions and base my article on those answers. It looks like John Carmack decided to write the article for me. I want to thank him for the time it took to answer my questions so thoroughly. He is an incredibly busy man who

has a very active fanbase that sends him 50 emails a day. Please take note of his PS note at the bottom. Respecting this, I will ask for no more interviews from him until at least 1998 :). I think he would appreciate it if everyone else took his caution to heart and not start sending him a lot of email with questions.

This interview and further editorial articles will be posted on Dark Requiem's homepage as soon as DR_|2| has enough free time to devote to the new "Dark Tribune" section of the page. This has been in the works for a while, and already has several articles ready to go. DR_|2| is also a busy man, and his professional concerns take precedence over the "Dark Tribune". It'll be up "when it is finished" :)

Questions

Bone: Just a recent development. Shawn Green has left id for Ion Storm. It seems that there have been a LOT of defections from id over the past few months. How does this affect id in terms of workload? Id has always been a small development community, but aren't you guys reaching critical mass where the workload becomes too much?

John Carmack: Lots of people will read what they like into the the departures from Id, but our development team is at least as strong now as it has ever been.

Romero was pushed out of id because he wasn't working hard enough. We have hired Paul Steed, a new artist.

That is the balance of changes to our development team. I believe that three programmers, three artists, and three level designers can still create the best games in the world.

The other departures have been from our biz/support side, which doesn't have anything to do with product creation. We are scaling back our publishing biz so that we are mostly just a developer. This was always a major point of conflict with Romero – he wants an empire, I just want to create good programs. Everyone is happy now.

Bone: As always, id leads the industry in technical terms, and others follow behind. However, isn't there a boundary to how much more you can do given current input/output technologies? Doesn't it then fall to the point of "artistry"? What prompts this question is many of the screenshots I've seen of Unreal. Some of the texture-mapping and monsters are just stunning in their artistry. How can id compete with companies that employ dozens of artists in their 3d efforts? It just seems that the "push the technology farther" answer is simply not much of an option anymore until the next input/output technological breakthrough comes along.

John Carmack: The official codename for the next generation game engine is "trinity". There is no information to be gleaned from that, we just need something to call it when it is discussed.

The architecture for trinity is well underway, and it will be dramatically better in many ways. In fact, this next generation has more distinction than any before it, because it is the first of the transition from the pixel to the texture mapped triangle. Assumptions change and new capabilities arise beyond what a simple processor speed increase would have given. Pushing the technology is a long way from over, trust me.

As far as unreal goes, we can't compete with an unreleased product, because a non existent product does everything you dream of and has no faults. Think back to what everyone thought quake was before anything was released. I wish Epic well, in any case. Unlike some other companies, the principle developers at Epic have not involved themselves in any mudslinging.

It is also a mistake to think that Id's games ride on technology alone. DOOM and Quake aren't just the minimum work required to make a 3d and networking engine a game – they are the right game elements as well.

A user always wants more of everything – more features, more artwork, more levels. The assumption that hiring more people gives a better product is often incorrect. It might (but not always) get you MORE product, but not necessarily BETTER product.

Bone: In the heyday when Quake was about to be released id had a strong presence on the net with informative .plan files, and romero would actually appear on the undernet sometimes to brave the IRC nightmare to

answer questions and just be involved. It seems that id has closed up since then and not been as involved with communicating with their end-users. Some of the people complain that id has stopped being interested in getting the community *involved* with the process of software development. They feel left out. I have not felt this personally, since I was part of the beta program for QW, but I was in the extreme minority. Is this lack of info simply because you are too busy with Quake II or is it a reaction to the fact that the main ego at id (Romero) had left and there simply wasn't a spokesperson left?

John Carmack: Romero was going on IRC when he should have been working, from my point of view.

I listen a lot to the user community, but I make no apologies for prioritizing heavily. A suggestion or opinion from Blue, Scary, Disruptor, or one of the many people that publicly devote much time and effort to the quake community gets orders of magnitude more weight than Joe Random User's one-liner on IRC.

I get about 50 emails a day, which chews up quite a bit of time that could be used for programming. I'm not willing to sacrifice any more of my time to be active on newsgroups or IRC.

BTW, I rejected two other interviews today.

Bone: I know that the Next Generation Technology is tightly under wraps, and probably you have only the vaguest feel for what you to do next, and I will not ask about specifics. However, there are certain limitations that seemed to have been introduced into Quake while trying to make it work on a 486 with 8 megs of RAM. Due to the fact that the Pentium has taken off and that RAM prices have gotten so low that 16 megs is standard and 32 megs is VERY common, those limitations seem to be not needed anymore. There is one overriding example of this that I can come up with off the cuff. You can't see into water or out of water, yet the Unreal pictures show that realistic looking pools of water CAN be made. Other, more nebulous limitations, include size of the levels, specifically I have seen levels with HUGE open spaces that "gray out" due to limitations in VIS-ing those large areas. Also dynamic shadows seems to have been included in Unreal but are static in Quake. Is there any plans at all to get rid of these limitations by increasing processor speed requirements and

RAM requirements?

John Carmack: Note that it is easy for an enthusiast to have a rather self centered view of the market. 32 meg systems are NOT common in the general population right now. Basically, everyone wants the games to be designed for their own systems. :-) The system spec for trinity would probably sound excessive to you right now. Your current system almost certainly isn't up to par, but you will probably buy a new system be the time a game ships.

Quake will have some new features added to the engine during Quake 2, but it will not change drastically. Drastic changes are in new technology generations.

I start fresh with a blank edit window for each generation, and architecturally the next generation will bear about as much resemblance to quake as quake did to doom. This is the right way (as I see it, in any case) to add features: a cohesive whole that is deigned to offer a well balanced experience, not one feature at a time just to play catchup or leapfrog.

Glquake has shadows and mirrors, but those are novelty features and not rigorously implemented. The game wasn't designed around them, and we won't exploit them.

I could add transparent water to glquake pretty easy, but the vis information in the current maps breaks at water boundaries (it saves a LOT of polys in many scenes), so you would never be able to see it in existing maps without re-vising them with a different utility.

< ok, I just went and added optional transparent water to glquake and the utilities (American had been bugging me about that for a while as well...). You can set r_blendwater 1 and run either a novised map or a map processed with qbsp2 -watervis. Yes, it looks sort of neat. No, it's not earthshaking. I'll release a test map when glquake goes public. >

The greyouts in huge scenes don't happen in glquake, and can be avoided in software by increasing the surfaces and edge arrays. That was a tough balancing act to run on 8 meg systems. Actually, building those large intermediate tables was probably not The Right Thing in the quake engine. I feel that could have been done a little better with a different approach.

We might try some other things out in quake 2.

Bone: While there is no doubting that Quake excels at DeathMatch play, and indeed might be the best DeathMatch game ever created, people were really expecting some more "world dynamics" to coin a phrase. The lack of interactive elements in the game had somewhat marred single-player Quake games (but oddly enough provided just the right balance between simplicity/complexity for DeathMatch). Are there any plans in the future for making future levels more dynamic in single player mode? I hesitate to give any examples here since it is a question of game design and purely your province. Perhaps more ambient sounds? (gurgling pools, dripping water, metal tapping against rocks) Not my strong suit, so I'll just leave it at that.

John Carmack: I will always take an aggressively simple approach to things, but yes, I agree that we should add more interactive elements in the future.

Another major way to improve the single player experience is with more skill and timing based actions, but the wide range of computer performance in our audience makes that a lot dicier than on a fixed game console platform. I intend to multi-thread the control in trinity, which should allow proper timing based maneuvers on any speed system.

Bone: Aside from the base desire for dominance and violence, do you have any higher goals for the technology that is being developed for Quake? I once read an article where it was stated the Mike Abrash was lured away from Microsoft by the promise of using the Quake technology to advance his goal of creating a "Snow Crash" type of environment with a virtual world that people can "live" in and create avatars to walk around in. I myself find this scenario somewhat compelling. Sort of a graphical, 3D realtime IRC. With Quake this seems to be tantalizingly within our grasp. What are your thoughts about using Quake for communication purposes other than just a game?

John Carmack: There will probably be some work in this area by other people with quake technology. Trinity will be even more flexible in this regard.

Bone: Clans seem to be a totally unexpected phenomenon in the history

of computer gaming. It's predecessors in MUDs seem to totally pale in comparison in terms of popularity. Although id played somewhat of a bystander role in the development of clans, are there any plans to become more involved with the clan phenomenon?

John Carmack: It was so odd the way it happened – internally, we had talked of clans of warriors before the game was released, but I don't think we ever publicly talked about it, and to have the same terminology apparently spontaneously evolve in the user community was pretty weird. I love it.

I don't want id to "involve" itself in much of anything on an official basis. I want to make the tools and capabilities available to the user community and let them self organize. We would need more people at id to stay involved with all the cool stuff going on, and I really don't want to grow the company.

John Carmack

ps: this really did take quite some time and effort to answer, so please don't take my response as an invitation to regularly interview me – I don't like refusing people, but it just becomes necessary.

CHAPTER 1. JOHN CARMACK INTERVIEW

Chapter 2

John Carmack - The Boot Interview

This interview was conducted by Alex St. John for Boot Net on Nov 25, 1997.

http://web.archive.org/web/19980130151620/www.bootnet.com/youaskedforit/
lip_16_outtakes.html

Interview

Prologue

Be sure to log onto the bootNet site everyday and read these exclusive, never-before-seen outtakes from boot magazine's interview with id software's John Carmack and Brian Hook.

The interview was conducted by the architect of DirectX, Alex St. John, a monthly columnist for boot.

At the end of the countdown, the entire Lip interview that ran in the print version of the magazine will be posted. Be here!

Questions

2.1 Page 1

Alex St. John: Lets talk about DirectX.

John Carmack: DirectX had all the right goals and, for the most part, it achieved those goals. Certainly it didn't turn out perfect, and there's lots of things that could have been improved, right? But the things that were absolutely necessary–DirectDraw, DirectSound–they basically work.

Alex St. John: Is John being a little gratuitous in his praise here?

Hook: He's being nice.

Alex St. John: Do you have a problem with DirectX?

Hook: No. But you should have been here last night while we were trying to work out some DirectDraw stuff–I don't think John would've been liking DirectX pretty much then, right?

John Carmack: It could be better. But I'm glad it's there, rather than nothing at all. I would separate Direct3D as a totally separate issue because that wasn't part of the original spec.

I'm on the side of it being really simple and doing it right. And Microsoft has a lot of pressure to drift toward supporting everything and the kitchen sink approach. But it's just like the issue of software reliability and usability: The further down there you go, the more things fall apart.

Alex St. John: I've read a bunch of the e-mail boot gets from people raving about D3D sucking and OpenGL being awesome. And then they substantiate it with really weak paraphrasing of all the stuff John has said in his plan file.

John Carmack: You wind up getting this sense of partisanship or just taking sides. It's human nature, I suppose, but when it gets away from a strict technical discussion, then you start getting your "army of followers." I suppose that's part of having influence, but it's not a part that I'm particularly comfortable with.

Hook: That does bother me, because there are a lot of people who will mindlessly listen to what John and I say, and say, "Yeah, yeah. Completely." And they haven't stopped to apply the critical thinking the way I would like it. And they're free to disagree because I'm not a God. I don't have some comprehensive understanding of the Universe that no one else does. So what I say is definitely going to be incorrect at times, and people need to stop and think about that.

Quake followers are sort of understandable but it's so weird seeing products like Prey and Unreal that already have rabid followings, but they haven't even been released. Not that they don't deserve it, but the fact that people can band together behind something that hasn't happened yet is kind of weird. And it shows this aspect of human nature to I don't even know what aspect it shows.

John Carmack: There are people on the Unreal or Prey bandwagon that just write off anything we say out of hand because we're the enemy. That's just screwed up.

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Alex St. John: Brian, we understand you weren't John's first choice for the job. Are you Mike Abrash's replacement?

Hook: I'm not Mike Abrash's replacement–let's get that real clear.

John Carmack: We don't have job slots. We have talented people that work to achieve the best product we can. And Brian fits in differently than Michael did.

Alex St. John: Brian used to work at 3Dfx, right?

Hook: Yeah. After 3Dfx I went and contracted for eight months or a year. And that was fun, but it kind of sucks working at home. There's none of the camaraderie, you can't talk to people, bounce ideas around. It's cool because it's really the most relaxing thing in the world, working 20 hours a week and making twice as much as you did working 80 hours a week. But after awhile, you just get bored. And miraculously about that same time,

I got e-mail from John saying, "Would you be interested in contracting down here for like a week or two?" And that was going a little too slowly, so he said "Well, would you be willing to come down here and interview and meet some people and maybe talk about a job?" And then like a day later he said "Fuck, do you want the job or not?" And I was like "Oh shit, that puts a spin on things." And I said "I guess." And, boom, I was here.

Everybody has this picture of how id is the most wonderful place to work but I came from a different perspective. There were issues... everybody was abandoning id, right? So I was a little distressed and I called up Michael and said "Before I commit, I need to know the reason you're leaving id." And he was like "Dude, I would work for id if they were in Seattle." That sold me.

John Carmack: Two years ago I had the actual honest thought that "You know, it's really good when we get these sharp new people in here. Maybe there should just be this plan to fire the little man on the totem pole every year and bring in fresh blood."

Alex St. John: So how is Brian holding up here?

John Carmack: Brian's done really well because he's probably working the longest hours of anyone here like 90 hours a week. I've been holding my 70 hours for six years now. Two years ago, I was the only person here at night. It's just wonderful now to have some other people that are here as much as I am, working hard on things.

Hook: It really isn't necessarily the number of hours you work–it's the how productive you are. When I first got here, I wasn't particularly productive even though I worked long hours. There's a huge ramp-up phase where you can't get much work done because you don't understand the system, and you don't know how the code base works. Now we're on the same wavelength and I'm a forced multiplier, right? It's just like John and I agree on so many things. And it's spooky. I'll be sitting there trying to change OpenGL drivers on-the-fly, and at the exact same time we'll both say, "Hey, that's cool!" It's trivial, but the fact that we can swap going from 3Dfx to the Intergraph on-the-fly, and we're both thinking "Yes, that's so cool!" It's just really neat working in an environment like that.

Alex St. John: How do you feel about the phenomena of female Quake

players?

John Carmack: I was really shocked by the size of the female Quake players.

Alex St. John: Shocked by the size of them? [everyone laughs]

John Carmack: Shocked by how many... I never would have guessed that there were so many women that played Quake. And the fact that some are so damn good, like out of the top 10 or 20 players, probably two or three of them are female. Figuring about 1% of the players are females, but maybe 10% of the very best players are female. That's interesting.

2.3 Page 3

Alex St. John: What do you think of the Talisman architecture?

John Carmack: The Talisman architecture is based on a fundamental assumption that turned out to be wrong: memory prices and speeds and densities are going along this slow stable, path where all the processing elements are drastically outpacing them.

Now we've got 100+MHz SDRAMs at $3/MB for commodity prices.

But even if their assumptions were right, there are different critiques that can be made of the architecture. The most classically Talisman thing is the compositing of multiple layers to produce a scene, saving time by caching one layer and reusing it. Now I've worked on a couple of things similar to that. With Atari Jaguar programming, there was a way you could program their video controller to do layers, similar in a primitive way to what Talisman could do. A chain of layers could be combined, they could be scaled and translated, but they couldn't be rotated, they weren't anti-aliased. But the concepts are identical. You can build something with that.

Alex St. John: So the industry is stuck on an old Atari concept?

John Carmack: Yeah. And it was really a pretty clever concept in the constraints of 2D games, especially because you've got your parallax layers

and they had this neat way of generalizing a sprite-based architecture. It was a more general-purpose architecture where you could use the same thing for your background as for your objects. And for 2D games it had wonderful advantages, but in a 3D environment a lot of those assumptions on reusability do not follow nearly as well.

Alex St. John: Do you feel the Talisman architecture will become the pervasive 3D chip technology?

John Carmack: I don't think it will because it's more expensive than other things which do the job right. And if you don't specifically optimize for layers, what you've got is a 3D accelerator with compressed textures and anistropic filtering, which are both good things that I expect everyone to eventually adopt. But if you look at their chunked architecture, the performance has some interesting things you can say about it. PowerVR does a lot of the things that Talisman hopes to do some time in the future. In some cases it performs better than I'd expect. But in the end, it's fundamentally not going to be as good as something you directly feed vertexes to, because it involves chunking, copying, and scatter gathering to memory. All these things compromise it at the high-end.

We investigated an amazing number of things in Quake. One was, "Alright, rendering these 3D models composed of several hundred triangles takes a lot of time and we can't have these huge scenes all the fire fights like we had in Doom. And that's a bad thing." So one thing we looked at was "Well, let's cache it into a sprite and then re-use that sprite for a few times." That's exactly the Talisman architecture. Now we went and put it in, and not only did we notice all these visual anomalies. One of the most wonderful things in Quake is that you're there in the 3D world. But if you're caching a sprite and re-using it, it's not like that.

We saw that technology and it kind of sucked. And then we ran into all these other things we hadn't even thought about, like where you place the sprite projection plane. If you put it at the front, then it actually extends below the ground on there. You run into these weird clipping problems. And turning a 3D object into a 2D poster then integrating with a 3D world is trickier than it might look. Lighting is obviously not going to be right any time you re-use it. That may not be a big deal, but the interpenetration occlusion is the biggest part. And what we found is you just

can't re-use it for many frames.

Alex St. John: So what should Microsoft do with Talisman?

John Carmack: It should just quietly go away, because there's wrong fundamental assumptions. There's some really great thinking and engineering that went into it, but if you start with this straightjacket of memory, it's just going to get worse by this horrible bandwidth problem. We need to be really clever to get around it. You can defend a lot of these things by saying "If we need this level of performance and quality and we cannot have this memory, then this may be the only way to achieve it." There may be other viable things–caching and all that–and I can respect a lot of the science that went into it, but the world changed and it's not appropriate anymore.

The key to Talisman was layering, which was just a bad idea. Then they had a bunch of things like shadow buffer algorithms and foretelling how important a multipass was going to be, and those are all right on. There's a lot of right things in there.

The jury is still out on chunking–it may or may not be a good thing. PowerVR and Oak are following that line and 3Dfx is not. And they both seem to be doing well. So that's a debatable point.

2.4   Page 4

Alex St. John: What do you think of Sega's decision to use PowerVR instead of 3Dfx for its next-generation console?

John Carmack: Well if you compare the two, interesting trade-offs are being made. Look at it in the PC space: 3Dfx costs almost twice as much as the PowerVR. So in a console space, $100 difference could be crucially significant. You can say that's a strong argument for PowerVR, but that's not really a truthful case. PowerVR is only cheaper because it uses other components already in the PC–the video scan out, main memory for chunking buffers, and all this stuff–which would have to be present in a console anyway. It does use a less aggressive memory subsystem, so the PowerVR system might have a slight cost edge. But one hidden cost is

that chunking requires a large main memory buffer to specify your entire scene database in Primitive. To get maximum performance, you have to do double buffering. You have to have enough memory to get two entire scenes worth of rendering commands in main memory. In a PC with 32MB and games that only have 5,000 triangles, that's not that bad. It's a few hundred K. But look at the performance we're going to expect of these next-generation chips, we're going to have games that are doing 15,000 or 20,000 or 30,000 polygons a second and reasonable frame rates. Now, run through the numbers. 30,000 triangles at 100 bytes per triangle. That's quite a bit right there. And then you have to double buffer it. Chunking imposes, on average, a 25% penalty. And now it's like "Wow! To do this high-performance game, I need 3MB just in memory." And consoles don't have that much memory. They're certainly going to go up in the next generation. I don't know how much it's going to be, but a good guess would be 16MB. And you're going to cut-off three megs just because you're using this architecture chip? I think that's a bad call.

Alex St. John: How do you feel about the possibility of Sega's operating system being a Windows CE subset of DirectX?

John Carmack: An operating system on game consoles does not help you get better games. I stand by that quite resolutely.

Alex St. John: Very few best selling games on the PC don't use 3D–Myst, Diablo, Barbie, Scrabble, Monopoly.

John Carmack: 3D is going to be separate from the operating system issue. An operating system does not provide 3D, really. It may provide an API. For a good example, look at the OS on the 3DO. It was a horribly bad idea. It sucked-up resources, it kept programmers from doing the most impressive things and going directly to the hardware, it had this vague notion of being portable across multiple implementations and evolving. And none of that really panned-out. And I don't think it ever will.

What a game developer would most like to see is an architecture exposed to the metal and then lots of libraries. Developers don't want to write a TCP/IP stack for a modem. It would be a ton of work and it wouldn't really be that good. By the same token, they'd like to have that provided, but they don't want an operating system that's going to disable write permission to the hardware registers. "Oh developers shouldn't be touching

those things."

That's throwing away the best benefit of consoles.

You can just optimize the hell out of consoles and you don't have that on the PC because you've got this staid, mushy, amorphous space to work on. So it makes people lazy. You can always say "Well, we slipped a little bit here, but computers are getting faster and we'll just let it slide." On the console you say "We're missing our frame rate here. This sucks right here–you need to make it better." And you've got the low-level access, you've got a memory map, you've got registers you can go down, and you can get a level of tuning that's just not possible on the PC. At least not in any economically viable sense. The few people that do that, like the demo crews, don't make money at it because it's tightly constrained. And it would be a criminal shame to just turn the console into a weak, underpowered PC with no hard drive.

Alex St. John: But wouldn't it make the transition from one generation of console to the next better if existing content continued to run on it?

John Carmack: I don't think that is beneficial to the consumer. Having last year's games on your new system doesn't really help. They tried that before, like the Sega Master System plug-in for the Genesis. Nintendo was going to have compatibility with the Super Nintendo. They chose the same processor generation and all, but in the end it never happened and nobody cared because nobody cares about last year's games. And for the consumer, it's not like they have to throw away their old game machine when they upgrade.

Each generation of console is like 5 times better than the previous one and there are scalability limits to all projects. Everybody talks about infinite scalability, but it doesn't exist because you choose a target and then do something appropriate for that. And maybe you've got a factor of 5 scalability, but that's really pushing it and it's clearly not that appropriate on the end of your spectrum. So content is not going to scale over two separate hardware generations. If consoles turn the same thing as the PC, where you've got this amorphous mess with "This is a 166MHz and this is a 200MHz," then it's just back to being a cheap PC.

2.5 Page 5

Alex St. John: id doesn't permit magazines to distribute the demo Quake shareware.

John Carmack: Right.

Alex St. John: So you guys kind of pioneered the whole shareware thing. What happened to the "share" part?

John Carmack: Well, okay. We found out that all these people are making tons of money, in some cases millions of dollars, distributing our games. It really started sinking in that people are buying this CD just because it's got our product on it. We looked at that and said "Okay, you're going to have to pay us $6 per CD." And we did that for a little while and that was something that we didn't do particularly well for a large number of reasons.

But it turned out that people were willing to pay for it.

Alex St. John: You're not a shareware company anymore.

John Carmack: Free distribution is great because the more people that see this stuff, the better. And the Internet distribution is still free. On the Internet, no one else is making money from it. Part of it is, "Well, that's our money!" And that's caused a number of arguments at id about how far we pursue that analogy, because it can get us into all sorts of areas that I personally don't want the company getting into. But it turns out that we made a quarter of a million dollars on top of everything else. It was just, "Well, why not?"

Alex St. John: So you won't allow boot to publish the shareware, because it helps sell the magazine, and it should be you getting the money?

John Carmack: To a degree. It always used to be presented like, "Look, we're doing you guys a favor by distributing your software." And we looked at it like "No, we're doing you a favor," and there's no good rational reason why we should do that because we still got free distribution on the net. We get the money. It's not a religious issue one way or the other. We've just kind of started doing it.

2.6 Page 6

Alex St. John: When are you going to do a Java version of Quake?

John Carmack: Java has a lot of wonderful advantages as a program development language and I do plan, after we finish Quake 2, to go off and develop something significant in Java to feel-up the language. I haven't done hands-on work with Java, but I think there's really something there to be gained. We don't have a lot of ties holding us back at id and we developed on this crazy NextStep platform for a long time and we're willing to push OpenGL or maybe jump to Rhapsody. And if Java pans out the way I think it might, then we might write a lot of things in Java.

Alex St. John: Do you think Java is fast enough for games?

John Carmack: This is one thing that I don't really understand about the whole Java marketplace and the way it's being presented. It also ties to this bytecode portability stuff and there's no damn good reason for that. Why don't we just have Java and X86 compilers? I like the language–I don't care about bytecode.

Alex St. John: The portability of Java isn't a feature. It's just a language, and it would be nice to have a better compiler.

John Carmack: Exactly. I think it's a language that in many ways is better than

C++ and I'd rather develop something in that, but it's all tied-up in this non-proprietary, run-anywhere type of thing, which is not what I care about.

Alex St. John: The whole Java virtual machine thing doesn't turn you on?

John Carmack: No, not at all. I like the language.

In general, I'm willing to spend performance to make a better product. And that's one thing that has taken me awhile to kind of mature to because all game programmers start off on "I can do this in 10 cycles!" And games have gotten so complex where Quake is practically an operating system. It's this architecture, with all these different things that plug-in different ways, and it's not just this little thing that draws to the screen.

So design and the implementation of things in robust ways is really important. And we've still got lots that we can improve here. I'm trying to learn and teach myself to be better in these ways, but performance is not the only criteria.

When it comes to this sort of thing, I think Nintendo and Sega can make a better consumer network computer than like Oracle or Sun can. They know what they're doing better in that segment and the computers are certainly powerful enough. An Ultra 64's got a 100MHz processor, several megabytes of memory, excellent display output. You can do great things with that. And I think modem peripherals are going to be extremely significant in this coming generation. I know they're on the current generation of Saturns and whatever, but it's not the cornerstone yet. But when it becomes the cornerstone that's when things are going to get interesting. There's some wonderful things people can do if they own modems. There's certain modulation things they can do at a hardware level to get rid of some of the crap that goes on the PCs, so you get a better connection to play real-time games.

They can do things asynchronously on their end.

And then there's wonderful possibilities if they cut a deal with say Ascend or one of the digital emulation modem banks that ISPs use and you can negotiate a real-time protocol that gets less bandwidth but at much less latency.

Alex St. John: Communicating directly through the POPs, without going over the net?

John Carmack: Yeah. You still have to go analog to handle the POP line, but you can avoid going back on the ISP side, which is what 56K modems are talking about doing. Those are still optimized for bandwidth. If you took the same decisions, the same technical bases, and optimized for latency–not caring about dropped packets or bandwidth–that would be wonderful for games. And it could even be done with total compatibility.

The things I think are going to be sticky are the political realities of Sega and Nintendo. They're closed boxes, and they make all their money by forcing anyone running on their platform to pay through the nose. And I absolutely hate it. But the net is 180 degrees away from that. If a browser

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supports Java or something, then all of the sudden, you've got people writing programs on that system. Sure, they're not accessing their hardware, they're not efficient... but still, it's like this horrible foot in the door that I'm sure is going to make all of them really sick to think about. You have somebody running a program and that money is not funneling through them in a license. And I'm afraid that's going to make them do so horribly wrong.

Alex St. John: Proprietary technology will prevent any of that.

John Carmack: And that is so appallingly wrong. It's hard to express how wrong that really is. I've got this feeling things like that are going to happen. I don't think Sega has the guts to be this network computer that does all these wonderful things in addition to just play games.

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Alex St. John: How do you feel about the top 10 list of PC games being saturated with non-3D games such as Scrabble, Barbie Fashion Designer, and Myst?

John Carmack: We've never claimed to represent the majority of the market. It's not something that we even care about. We don't want to write Myst or something like that, and even if somebody said "Look, we can give you five times as much money to do that" It's not enough draw. We're not trying to own the market. It's nice to have millions of people like the product and all, but not if you're doing something you don't care about, you're just selling out to please the most number of people.

Alex St. John: Certain large game companies seem to attempt to dominate every inch of the game market by generating a product that fits each niche.

John Carmack: I had this really bizarre conversation once with a couple of lawyers and they were talking about "How do you pick your target market? Do you use focus groups and poll people and all this?" It's like "No, we just write games that we think are cool." They're from such a different world that they fundamentally did not get that. We are not run-

ning things the way a business should be run, that that's just not the way things work. It can't work like that, but it does. It works that way for us.

There's plenty of starving artists that are probably talented and hard working, they're just doing something that nobody cares about. I happen to be good at something that makes me millions of dollars.

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Alex St. John: I understand that when you guys saw the Into the Shadows demo, you were pretty traumatized.

John Carmack: I looked at that and said, "Their characters look better than ours." But even though it was an impressive demo, it's a perfect example of the difference between a technology demo and a shipping product. And shipping a product is just horrid. People don't realize it. You get so many people that are from an EEU background and don't know what they're talking about. And they think just because, "Wow I did my senior project on this, I know everything it takes to do a game..." The graphics technology everybody looks at is only a quarter of Quake's code, and it's not even the hard part of it. Look at the things that are really unglamorous but really important, like the file extension architecture in Quake: I rewrite everything down to my disk reads and file I/Os between technology generations. And the decisions I made on Quake were just crucially important because I looked at what we've been doing in the past, and I made the right decisions in the data structure file system to allow it to be extended completely.

Hook: Quake is far more popular today than when it was released. Easily. And you almost never see that. Games have that spike in popularity. Everybody solves it, then it drifts away.

John Carmack: Yeah, like Diablo. There was a huge spike where everybody was playing Diablo and now? It's basically gone.

Hook: And with Quake, the number of people of playing it has just kept rising and rising and rising as people get turned on to it on the Internet. You should see these add-ons! There's Quake Rally, Quake Golf, and

there's Quake Soccer. It's just crazy what these people are doing. People are just going insane! There's even that Descent clone people did with Quake.

John Carmack: And Quake 2 is going to be even better, because all the things that frustrated people in the architecture of Quake are fixed now. Things like exact control over the view camera. That was always short-circuited on the camera. But now you can take precise control over that. Mostly it's a matter of making the client dumber and moving more control onto the server side where they can use it.

Alex St. John: So what platforms will you support with Quake 2?

Hook: Just to quickly go through: We're supporting Win32, x86, Win32 DEC Alpha, Linux x86, Rhapsody–both PowerPC and Intel.

John Carmack: It'll probably wind up on all the crazy Linux flavors, although some of those get really debatable. The intersection of people that run Quake on Linix, SPARC, and Light [?] is probably a dozen people. But if it's just a matter of compiling, we'll do it anyways.

Hook: And we do this, not because it makes any particularly good business sense, but because it's cool. All this is an ego thing. The more platforms you port to, the more people are playing your game. And it's a cool thing that someone can say "Yeah, I was playing Quake 2 on a SPARC Linux box."

John Carmack: It doesn't make good business case, but it does help us to be better programmers.

Alex St. John: What do you think of AGP?

John Carmack: AGP is not going to make any difference on titles shipping right now, but in two years, it's going to be absolutely necessary just for command bandwidth. The use of texturing over AGP is kind of a separate issue, where AGP can be looked at as just a multi-clock CPI. And in that case, it's clearly a pure benefit. Nothing in the world wrong with it. AGP's not going to provide tangible benefits to people right now, but it's going to enable the evolution of everything that's going to be significant in the future.

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Opening up 32MB of main memory for textures will be good.

Some of the main memory bandwidth is going to have benefits, or some drawbacks that you won't see in a benchmark. A benchmark you'll just see like raw fill rate. And they can clearly do pretty well there, but there'll be some other drawbacks. The highest performance things will still have dedicated texture buses. The biggest problem we have on 3Dfx right now is texture paging. Not triangle rate, not fill rate, it's textures.

And that broaches on another issue. We had a version of Quake that used portals. In fact, a month before Quake shipped I had a brainstorm that I thought might cause me to rewrite the engine along passages, which is kind of an extension of portals, and I tried it. In some cases it worked well, but overall it wasn't as good as what I was doing.

Alex St. John: When you say "portal," do you mean a teleporting base?

John Carmack: No, portal technology is being in an area and only drawing the area after it if you can see the portal that leads between the two areas. It's valid, and it's something that I'm going to re-evaluate again for Trinity because the situation has changed, but with the Quake level of technology, it was not the right thing. There are a few cool tricks you can do with portal, you can have your window sitting in space and you can walk around and you see another area through it. There are good technical reasons for doing that, but 3D Realms and the press wound up touting portals. They say things like "The previous-generation VSP technology and current-generation portal technology." It's not really a matter of one being more advanced than the other, but this what non-technical people spin it as because they need something to talk about. You need some controversy, you need the sound bite that people will associate with. And you can't have this long thing about the technical trade-offs between doing things with statically computed things vs. dynamics because most people don't care enough to really get it. It's the job of the marketing person to condense it all down into one word.

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Chapter 3

John Carmack - The Boot Interview (Outtakes)

This interview was conducted by Alex St. John for Boot Net on Nov 25, 1997.

Interview

Prologue

On the first day, id Software created Wolfenstein 3D– the debut first-person shooter to confront the issue of 3D on the PC. And it was good. Soon, the small Texas-based startup had a shareware megahit with the legendary game Doom, and the game world began paying attention. Ambitiously, id set out to break its raycast bonds and create the first true 3D game. Thus was born Quake, arguably the best PC game to date, and nothing would be the same again.

Along the way, the technological idealists at id faced opposition. Mighty

Microsoft, via outspoken evangelist Alex St. John, began pushing Direct3D as the dominant API. But id had other preferences, and company owner/lead programmer John Carmack has rallied developers against D3D and become alternate API OpenGL's... Ad Hoc Evangelist

Questions

Alex St. John: If a Microsoft recruiter came down here and said "We'd like to hire you all to come fix DirectX" would you guys go?

Hook: I'd probably go. John wouldn't.

Alex St. John: So what would you do with Direct3D if you were in charge?

Hook: Hold it, hold it. There's too much speculation here. Having talked to enough ex-Microsoft employees, I know it's a very political landscape. It doesn't matter how good you are technologically, because there are people up there right now who have the capability to solve this problem, but politically do not. So you don't need me to go up there–what you need is someone up there willing to dictate on strategy, end of story, that's it.

John Carmack: Well, I don't know if I agree. I undervalue the strength of politics. I am a technical idealist at heart and I think that if you put someone up there that knows what the hell is going on, and they have authority over the code base, they can fix it. The final word is what gets built into the executables.

Hook: I think a pretty much infallible case has been made for OpenGL and Microsoft has effectively come back and said "Screw you."

John Carmack: [laughs] Brian's current conspiracy theory is that Microsoft is investing in Apple to force them to adopt D3D or something.

Alex St. John: That's not the most irrational thing we've heard. So, what do you two think about Microsoft showing GLQuake running on top of Direct3D?

John Carmack: It was worthwhile, although it's like you adopt OpenGL

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and write some emulation layer to run all the crappy games–such as Monster Truck Madness.

I've stated from really early on that the APIs are close enough in functionality that there's not a difference. The difference is in how you access that functionality.

Alex St. John: I understand the performance is pretty similar.

John Carmack: It's pretty close because it's a heavily fill-limited game, so you're bound-up by what the hardware can do. If the driver is not totally brain dead, it's feeding the hardware, and you wind up waiting for the hardware. So assume that you have a non-brain-dead driver, then you could put a layer of emulation between it. And that works fine on this generation of games, but it's not going to work in the future. If you scaleup the performance ladder– like where SGI is–then every access to memory is a performance drain. If you start saying "I want to render five million triangles," an emulation layer is not acceptable.

Hook: And Microsoft didn't tell us they were going to do an emulation. If they had simply asked "We're going to do this, do you mind?" We would have said OK, because we're just into cool technical stuff. There wouldn't have been a problem, but they didn't even do that.

Alex St. John: It was my job to get your approval, but they fired me before I could do it!

Hook: Look, this is my view of the people who work at Microsoft. You have a choice. If you're good enough, you have a choice of where you work. You have to realize that what you're doing is bad for the industry. And what you're doing is only good for your personal ego and your personal power trip and your stock options. If you're doing stuff that you don't even agree with and you do it for the money–we have a word for that.

Alex St. John: So what's that word?

Hook: A whore. And I've never done that. I can sleep well at night. Those people can't.

Alex St. John: Are there particular people that you have in mind?

Hook: No, I'm not even singling out the D3D team. I'm saying in general that you can have a certain level of honor and integrity, but not a lot of people exhibit that.

John Carmack: One thing the D3D/GLQuake demonstration did was draw the lines of battle. Microsoft is always trying to be friendly and put on a good face and saying "We're doing what the ISVs want" and everything. But that's really just a front. There's a well-defined agenda that D3D shall rule the universe; OpenGL shall crumble and die.

But Microsoft can't quite come out and say that. And I would respect them a hell of a lot more if they actually did, but they're trying to have your cake and eat it too. And it's just not that way.

Hook: Their D3D developer-relations guy sends e-mail asking if there's anything he can do. And then something happens and he'll say "Oh, I had nothing to do with that."

It's like "Fuck you! You work there." That's not my problem and I don't respect you for coming up with excuses when you come down here and start saying "Oh, we really want to work with you..." and then pull a stunt like that. You come off as two-faced, you come off as a hypocrite. If you want to work with us, pay attention to us. But it's not what they want to do. They say "Try D3D–you'll like it," And I kept saying "I don't want to use D3D. I have something else I like." To me, the analogy was like going to a fast food place and saying "I want a hamburger," and them saying, "We've got a really good chicken sandwich."

You know, we're not supposed to do what Microsoft wants. Microsoft is supposed to enable us to deliver content on their operating system, but they're not doing that. They're flat-out ignoring us to a large degree. And I've heard private comment from members of the Direct3D group where they just categorically ignore anything John Carmack says. Not because they don't believe in him, but because he disagrees with them. It's not John Carmack, it's anyone who disagrees with them. They've done this with hardware people. "Yeah, even though they're the fastest, they don't have enough volume. We don't really need to work with them..." And they do that across the board.

Alex St. John: SGI can't make much money licensing the OpenGL tech-

nology, so they really need to make an NT deal with Microsoft. How does that make you feel?

John Carmack: This is where I can just be righteously indignant and disgusted about them. I am a technical idealist and the wrong things are happening. I understand the reasons why some of them are happening and I'll probably learn to live with them, but it doesn't keep me from being pissed-off about it.

Alex St. John: So even if OpenGL dies, will you remain its torchbearer?

John Carmack: No. We're not going to crusade off a cliff. I am pragmatic at the end; there is a limit as to how much I will let idealism damage me because I can adapt to whatever is necessary and Direct3D with Draw primitive doesn't suck.

D3D sucks!

There's just nothing charitable you can say about it. Over the years, Microsoft will make D3D suck less, but they're dragging us through the mud along with them as they figure it out.

But in the end, if SGI did give up on OpenGL, we would give it up. I suppose the gentlemen's bet would be that they're not going to bow out in the next couple of years.

Alex St. John: I'll make that gentleman's bet: I predict SGI will become less interested in providing a consumer API on the PC for OpenGL...

John Carmack: Certainly, but they're not going to start running D3D on Infinite Reality.

Alex St. John: At least not for a while. On the other hand, their product mix might increasingly become whatever Microsoft supports under NT.

John Carmack: And I think that's wonderful. If we could buy Infinite Reality and plug into an NT workstation, we'd do so. I'd write that $100,000 check right now because I don't like Irix. I don't like their desktop and their operating systems.

Alex St. John: Do you see hardware companies making a special effort to build drivers just for Quake as a problem?

John Carmack: They aren't just for Quake. A couple are just for Quake now–the 3Dfx and PowerVR ones–although they both intend to evolve to a full version. There are a lot of great things people can do with them.

D3D is not being exercised in application mode. And this is where everybody has always had these vague notions that 3D is going to be important on the desktop. And while I don't think that's really near-term, in general, it's true: You are going to integrate 3D in your desktop experience ... and that's what OpenGL was designed for. It runs full-screen. That was kind of a side-effect, but doing applications on a simple level–such as our map editor and the tools we write here–are things I can whip-out really easily in OpenGL and they work really well. And there are going to be consumer-level things like that which are interesting, and you'll want a robust, full OpenGL driver for.

Alex St. John: So you think people will be using OpenGL in Excel-type applications?

John Carmack: Actually, yes–drawing 3D graphs and everything in spreadsheets is an excellent use for something like that, rather than writing your own 3D transport clip project pipeline to do those little things. But the obvious things of the graphics tools, modelers, map creators, and things like that. It's silly not to write those to an API.

In fact there's a funny thing... Somebody sent me back an e-mail that I had written at least a year ago, where I said, "You should use a commercially available API like Direct 3D." That was before I had done any Direct3D programming. This guy sent it back to me, and it's like "You said this?" It was like, "Yeah, I did say that. I stand by the sentiment that you should use someone else's library." After actually doing a bunch of D3D programming, we recommend using OpenGL, for sure. But at the time, I hadn't used either.

It's important to note that some people have this misconception that we're just being recalcitrant and not wanting to learn something new. But I did Direct3D programming and Brian's done a lot. The thing is: I've only learned OpenGL over the last two years. It's not like I'm some guy at SGI who's been doing it for a decade. I learned it after I left NextStep and then I learned D3D later because I had the best of intentions. I went into it with eyes wide open, and it just sucked.

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Alex St. John: But clearly SGI isn't making a big effort to get drivers done and making sure that all the hardware manufacturers are unified...

Hook: They're working with every major IHV that I've been talking to. They're in constant negotiations. Their team is almost the size–in terms of programmers–of the Direct3D team up at Microsoft. They're taking this very seriously.

John Carmack: Sure, it could be better. It'd be great if they had an evangelist like you were for Microsoft. But we're still like this bug splat to Microsoft, and we can't get them to do what we think is right. This is the first time I'm really trying to use what influence I do have to do something I think is proper and forward-looking for the game industry. And I know I'm not really hurting anyone by doing this. I think that the long-term benefits of trying to push something that's right are good. At the very least, even if we fail, we have put pressure on D3D to examine some of the issues that they wouldn't have otherwise.

And I do get mail from people. Most of them really don't understand the issues technically. They think when GLQuake is running on their S3 ViRGE, "If it just supported D3D..."

I didn't know any better two years ago, before I used OpenGL. I clearly remember laughing about this e-mail saying how OpenGL is going to take over the world, and there are going to be OpenGL accelerators in the consumer space, and anyone would be able to write stuff on those. And I was laughing because the misconception I had was, "Yeah, anyone that runs a $50,000 SGI workstation." Something that's appropriate there just can't be efficient, because they're throwing all this hardware at it. And I was just wrong.

I just didn't know the issues and I learned better. And a lot of game developers haven't been in the position where they've had the opportunity to learn some of these things and they just take what's available and it's been bad. It's bad for the industry that what's available hasn't been as good as it should have been. But people really don't know there's an option.

Hook: People point out how OpenGL is designed on high-end workstations, but keep in mind that the "high-end" workstation OpenGL was designed on didn't even have hardware texture mapping. And a lot of them

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are significantly less powerful than a Pentium 166–even today.

John Carmack: So it's like they had all these years of evolution and we're now at a point where we can say "They've spent a lot of time getting it to work on this hardware. And now our hardware is pretty damn similar. Let's just take all this. Let's not re-invent everything."

And if you're going to re-invent the wheel, don't make it square.

Alex St. John: What would you think if SGI were to find a way to ship a PC version of OpenGL with Microsoft and doing the NT license for that workspace?

Hook: I personally can't believe it. It's a rumor. When it becomes a reality, I'll stress about it.

John Carmack: We have like plan A, B, C and D on what could happen with OpenGL.

The best plan would have been if Microsoft played ball and got behind us. That would have been best for everybody. But it didn't happen. So plan B is working with SGI. And if that falls through, the other ones probably really aren't worth pursuing as a long-term strategy. It would be strictly a rear-guard action.

If Microsoft does manage to effectively squash SGI's involvement, it may be time to pack up and move on.

Alex St. John: Will there be a Mac version of Quake 2 ?

John Carmack: Quake 2 is not going to be on MacOS 8, because I'm taking my idealist stand and saying Quake 2 will be available on Rhapsody. Give up the crusty old Mac stuff! I'm going to personally port the stuff to Rhapsody and make it a high-quality implementation for people that want to take a step into the future of Apple. I have no respect for the MacOS, none at all.

There's a chance that if Apple doesn't curl up and die and Rhapsody turns out to be everything that it looks like it's going to be, then next year we might jump ship and develop on Rhapsody and port to Windows. There's a lot of good reasons to not have your target platform be your development platform. It keeps you from accidentally doing things that aren't ro-

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bust and portable. And that was one thing during Doom and Quake, we developed exclusively on NextStep because cross-compiles were ported to DOS.

Alex St. John: Apple didn't come to you and say "Please put Quake 2 on Rhapsody"?

John Carmack: I have some issues with Steve Jobs. When he was running Next, I tried so hard to get any publicity I could for Next but, from what I hear third-hand, Steve Jobs just was not interested in any of that. And it's defensible in a workstation company, although it still would have been good free PR that they could have used. But I'm getting the vibe that he's squashing some things that are important at Apple, and he has no justification for doing that in a consumer operating system company. I've never met him–I'd like to some time, but I don't think he's exactly on my side.

Alex St. John: Brian, what do you think of 3Dfx's future prospects now that you don't work there?

Hook: I've always felt 3Dfx will do amazing stuff. I keep hearing rumors that there's political stuff in the semiconductor industry that will always hold small, fabless semiconductor companies like 3Dfx back. But I can't comment on that because I don't know enough to really say if that's a factor.

But remove that from the equation and I think 3Dfx Voodoo is still the best. Now that everybody's gone through multiple generations, this one architecture has lasted for a year. The boards are $180 for a 6MB version now, and you can get others for $150, and it's still competitive with brand new chips coming out from Invidia and Rendition.

John Carmack: They had a 4x performance lead when they came out. That is just so rare, they need to be lauded just for doing that, because it was an amazing thing.

Now I don't think they're going to have a 4x performance lead in the future, because eventually everyone is going to be working with the same memory subsystem, the same type of SDRAM, but I think they're still going to maintain a good 2x lead–and it's because they're really damn good.

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And I think they'll be successful. I don't think they're going to put S3 out of business, but I'm happy with the performance.

Alex St. John: That's a pretty strong statement. What don't you like about S3?

John Carmack: Well the ViRGE was the whipping child of the 3D industry because it was so bad. Just like 3Dfx was so good, ViRGE was so bad.

Alex St. John: You're pretty hopeful that S3 isn't going to be predominant in the marketplace?

John Carmack: Well anyone can turn it around. We've got a wonderful example with NVidia. The NV1 was the most stupid, wrong-headed thing anybody could have possibly built at that time. It was so bad it would have poisoned the industry if it had become a predominant thing– it was horrible. And now NV3 is probably the single-best chip solution available right now. They did the wrong thing, they recognized it, and then they did the right thing. So S3 may very well do that. I hope they do because they certainly still have a commanding presence and I just want lots of good chips in lots of people's hands, but I don't want lots of lousy chips in people's hands.

And it was funny, id Software had written off 3Dfx because when all the chip vendors came down and paraded through, 3Dfx said, "We're going to be $400." And we said, "You're not relevant!" We were behind Rendition because we felt they had the right feature set and they were going to be at the right price. But then RAM prices tumbled and, all of the sudden, 3Dfx is relevant. And not only are they relevant, they're so much better!

Memory is now cheap enough to use aggressively for graphics... and that's why 3Dfx is viable. If memory hadn't gone down, I'm not sure 3Dfx would still be in business.

Hook: 3Dfx's original business plan was not predicated upon having any presence in the consumer space for the first couple of years. They were going for massive arcade sales in order to keep the business going. Then they could get the prices down and work out the technology necessary to run in only two megabytes. But when the bottom fell out, all of a sudden 3Dfx was a consumer company. The arcade stuff became irrelevant, and

they spun-off their board division, Quantum 3D, because it's like, "We need to focus on the consumer space. This arcade stuff is not going to be nearly as important to us now as we thought it was going to be three years ago." It was smart because if you're just selling chips into arcades, the volumes are nothing. And 3Dfx makes the same amount of money whether they're selling chips to Gateway or Dell or Compaq as they would if they were selling to Konami or Midway or whoever else.

John Carmack: Well, that's one of those things that I can just look back on. I thought it was too expensive for us to be paying a lot of attention to consumer boards. But a lot of it was us believing what these people were telling us about their board's performance. Everyone said "Oh, we'll do 25 to 33 megapixels"–and we believed that!

Hook: They were running their SGI software emulation of what they would be capable of rendering.

John Carmack: And 3Dfx was saying "We'll do 45 megapixels" and we thought, "they're only 50% faster than these people but they're twice as expensive" and it's just not worth it. Then it turned out that the prices changed, everything became a lot cheaper. And everyone else under-delivered. And 3Dfx did not. They did what they said they would do and they did it well.

Alex St. John: What about non-Intel processors, what do you think of them?

John Carmack: The floating-point issue has really hurt them. We had AMD and Cyrix down here while we were developing Quake, and we said, "Look, floating point's going to be important," but because there weren't any benchmarks or any applications they'd used at that time, they brushed it under the rug.

AMD and Cyrix both have non-pipeline FPUs, which is their Achilles' heel. In terms of integer performance a lot of them are on par or, even in some cases, better than Intel, but we optimize for Intel because the Pentium's got the FXCH change trick to pipeline all these things. And it's pretty tweaky but it pervades all of our assembly language code for Quake.

So we're de-optimized for non-Intel chips, but it was the only sensible thing to do.

Hook: Intel was the best processor at the time. The K6 had not shipped yet, so it's hard to optimize for the K6 or the Cyrix M2 or whatever. They just didn't exist yet. So it's not favoritism towards Intel, it was just being pragmatic.

Alex St. John: What do you think of Intel buying-up interest in the major 3D chip companies?

John Carmack: Intel's a smart company, and Intel's turning themselves into this gigantic, monolithic company has been good for us. We have benefited very strongly by Intel's ramming through things like PCIs, taking over the motherboard chip and the L2 caches. Because every time they've done something like that, our life has gotten better, our systems have gotten more stable, more standardized. And they're moving into the 3D market with their Auburn part and I think that's going to be great. I think they're going to do a solid job. And if Intel murders S3, I don't think I'm going to shed too many tears. If we get a better part from a reliable supplier that's going to be on the motherboard of everything, wonderful!

Hook: And contrast that with Microsoft. You have two companies in similar positions: One in software and one in hardware. Intel is doing the right thing. PCI was better than VLB. Them owning the chipsets is a smart thing. They're doing CPUs that no one even thought technically possible with an x86 architecture. Contrast that with Microsoft, which has just made a habit of screwing things up. Making good business decisions, but screwing things up technically. If Microsoft was like Intel, it would have adopted OpenGL.

Alex St. John: I heard a rumor that id had a deal with Rendition requiring you to support their API only and that you couldn't ship anything else, except OpenGL.

John Carmack: Oh, OK, yeah. Originally we didn't have anything in place when we did VQuake. And in the end, my God, that took far more effort than we expected because of the performance required. The performance was really only good in some situations, and not the situations that it turned out we had to use, which included Z-buffering.

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Alex St. John: So what Verite chip problems are you responsible for...?

John Carmack: We were originally saying, "Z-buffering is important but you shouldn't have to run all these other APIs and everything, so Quake is not going to do Z-buffering." I said that and they probably still have the e-mail. And then halfway through Quake I said, "Well I changed my mind. We are using Z-buffering, even in software, because it turns out that it's the most effective thing for us to do."

And they're like "Oh great. We have Z-buffering, but it runs at half the speed of our non-Z-buffered algorithm." We did finally get VQuake running on their 3D stuff, because all through Quake we were concentrating on, "OK, how are we going to hook out hardware for this?" But when we implemented it that way, the performance was just wretched, totally not acceptable, even at low resolution.

We did finally get good performance out of VQuake. And I still find that a technical accomplishment. We took an architecture that had certain strengths and we leveraged it as well as was possible.

Alex St. John: Did you sign a contract restricting what kinds of technology you could do ports for?

John Carmack: We got some bundled deals, some things. Rendition offered us... I don't even know exactly what the specifics were, but I think there was like some stock involved or something, if we would sign an exclusive hardware agreement for a certain time frame. And we were looking at that saying "Well, we're not going to do anything else in that time frame, so we might as well."

Alex St. John: So that agreement stated that you can only ship 3D-hardware-accelerated software for a Rendition chip?

John Carmack: It was like no chip-specific ports or anything inside the space of three months or something. The only thing on the radar at that time was a Glide port. And I was like, "Well, maybe we could be talked into doing this because it is really cool." There's all this disinformation saying I did GLQuake for 3Dfx. In fact, I did it because I have an Intergraph workstation in my office that runs OpenGL and I wanted my game on my workstation. And 3Dfx was like, "You know, we could just write an

OpenGL subset that catches all that and it will run on our hardware."

Alex St. John: So the only way 3Dfx could get Quake running on their hardware was to write an OpenGL driver, because you could only ship an OpenGL version?

John Carmack: I forget exactly what the timing was on all this. We talked about letting them do a Glide port because they had a lot of the work done and we figured we'd give them the codebase and probably wouldn't even have to be involved in it much. But there were issues with the Verite port– if I could go back in time, I wouldn't have done it. It was too much work, too much distraction for Michael Abrash. And we were afraid of that happening again with another proprietary port. But the OpenGL stuff seemed to be the right thing.

And when I did the OpenGL version, I realized that even with all this sweat and labor, the Verite version was just awful–the OpenGL version was a pleasure to do.

I tried just a couple of features, like transparency or shadows and reflections. And they just dropped in–it was so wonderful. And that was what really got me crusading for OpenGL. It was like, "This helps me. This is not me laboring to produce something to deliver to the consumer. This is something that's letting me be more creative and try out more things to produce a better architecture than we would have had otherwise." And at that point I went and tried D3D and found out that it wasn't helping me do creative things. But I really learned something: A good API can help you produce better products.

Alex St. John: How do you handle third-party developers when you license your engines?

John Carmack: It's, "Here's a CD. Thank you for the half-million dollars. Have a nice life."

Alex St. John: Any truth to the rumor that Mindscape's upset about their licensing deal with you guys right now?

John Carmack: Mindscape had the very first Quake license and they signed a really nice contract where they got the codes, development, everything for cheap. They never got a team together and now they're try-

ing to say, "Well, we don't want to pay you this last $200,000 because we didn't do a game." And we're like, "Tough luck. You signed a contract. That's your fault."

Alex St. John: How important is software rendering to games these days?

John Carmack: I don't think software rendering has a future, especially once the hardware people get their shit together and are actually helping us instead of being this anchor that you get paid to support, like it is right now.

Trinity will not have a software renderer. Guaranteed. Well, theoretically you could have a software renderer, if you hook that up as an OpenGL bag. And who knows, maybe processors with unique architectural features will make it possible to do hardware-like rasterizing on a software level, but I doubt we'll have a pixel-level interface.

Now that means giving up a ton of stuff, but it's an architectural transition point and we have to lose some things to make the right steps in the future.

Hook: Adding power suits into Quake 2 took an hour and a half to get something we all agreed looked really good in hardware. Then to do the software version took four or five hours, even after the research was done on the OpenGL version. And the same with these translucent beams we do. OpenGL was "Boom, done!" Software, I had to go through and write new primitives. That took over a day.

Alex St. John: Bottom line, what should the next-generation 3D hardware accelerator be?

John Carmack: It should be a 3Dfx with integrated 2D and video-IN. That's the concise definition of what future hardware should be. And there's a couple coming out now that fit that bill. The NVidia RIVA 128, the Rendition V2200 and, to a lesser degree, the PerMedia P2. They're all single-chip cards that basically use the same memory and provide most of the features. In the case of the Rendition, they provide everything. They provide a wider feature base than 3Dfx without some of the limitations on texture aspects and format sizes. And they also provide acceptable 2D video.

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With all these pluses and minuses, I thought for sure there would be the clear winner by now. I remember thinking in January that in a couple of months the three survivors would be Voodoo Rush, the Verite V2200, and the PerMedia. It turned out that the PerMedia 1 had really bad visual fidelity. V2200 still hasn't shipped, delayed forever. And Voodoo Rush has limits, and they wound-up crippling some of the 3Dfx performance for architectural reasons. So they took a step forward and a step back.

Alex St. John: Is id going to have to start patenting its technologies to protect you from other people patenting things they use in their games?

John Carmack: Well, we get to the idealistic thing. The only time I've ever had to actually put my foot down at id was over a patent.

Alex St. John: You asserted your authority?!?

John Carmack: Yeah. The only time I have ever had to do that over other people's wishes was over software patents. Things were coming up about patenting things for protection, licensing, whatever, just for the reasons that lawyers give you. They were coming up and I said "No!" a bunch of times, and then they were being talked about when I wasn't there. And I delivered an ultimatum that said if id Software patents anything, they're going to be doing it without me because I will leave. And the fallout from that was not pretty. Everybody was pissed off at me, and I don't want to do that again. But that was something I felt strongly enough about that I, quite literally, would have left the company. I would've gone off and programmed on my mountaintop someplace.

Alex St. John: What if somebody patents the technology you want to use in Trinity ?

John Carmack: I really don't want to think about it. I'm sure eventually we'll get a demand letter from someone. I'll throw a lot of money at lawyers and say "Make this person go away," and we'll see how it goes. It's something that's really depressing because it's so horribly wrong for someone who's a creative engineering type to think about patenting a way of thinking. Even if you had something really, really clever, the idea that you're not going to allow someone else to follow that line of thought... All of science and technology is built standing on the shoulders of the people that come before you. Did Newton patent calculus and screw the

hell out of the other guy working on it? It's just so wrong, but it's what the business world does to things, and certainly the world is controlled by business interests. And technical idealists are a minority, but it doesn't mean that I have to drag myself to do things that I don't consider right.

Hook: It'll just be unfortunate when John comes up and says "Man, I came up with this really cool idea to do something, but some guy patented something that sounds sort of like this in a real general way, and we may not be able to use it." And what could've been the basis for a whole new completely cool architecture, and a new revolution in gaming is off limits.

John Carmack: Well, the argument is that we could always license it from them. That's what patents are supposed to protect.

Alex St. John: I know that's the specter raised by the whole Messiah controversy.

Hook: Dave Perry's comments would make sense if he were talking about copyrights. It's apparent that whoever's been educating him about this has not been doing a good job because the things he's talking about a patent protecting are not what a patent protects. He says, "We don't want people stealing our code." Well, copyrights protect you from that. It's important for the people at Shiny, or whoever else is doing software patents, to understand the difference between a software patent and the copyright because copyrights protect you in all the important ways that you really need to be protected.

We've even had people say "id shouldn't sue people for pirating your software because you're against software patents." That's a completely separate topic.

Alex St. John: If you could just hire anybody from the 3D world, who would you hire?

John Carmack: Well there's a big difference between who I consider the most talented and who I would necessarily hire, because you have to hire people that fit right. If I had to pick who I think is just the most talented, it would probably be Ken Silverman, the guy that did the BUILD engine. He does engines and tools. He's great as an editor. He writes all the code

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for everything, and he's just extremely talented. I think it was 3D Realms' worst decisions not to coddle him, or whatever it took, to keep him on board. I think if he was still working directly for 3D Realms, they would have a Quake-type game shipped by now, just because he's extraordinarily good. There's maybe a half dozen people that are top-notch A-level 3D programmers. I'm not going to give you a list because I'd leave somebody off and they'd be all pissed off at me.

Alex St. John: You've already left off 90% of them by naming Ken Silverman.

John Carmack: All the people doing things that people are talking about now are pretty talented. The Epic people have been working on it for a long time. They've gone through a big learning process, but they've got the issues under control and they're going to ship a product.

Alex St. John: So you think one day Tim Sweeney might grow to be as successful as you.

John Carmack: It's hard to become successful by following in footsteps. This is probably going to come out sounding demeaning, but Epic wants Unreal to be Quake. Everything they did with Unreal, they did because they wanted it to be like what Quake turned out to be. And they're going to achieve a lot of that, because they're doing a lot of things well, but you're just never as big when you're second in line.

Hook: Just like Dark Forces and Duke were both phenomenal games, they still definitely didn't have the impact of Doom simply because they just weren't first out the gate.

John Carmack: Like Prey, there's a lesson to be learned, something a lot of companies don't really ever learn. You hear it from the fan base a lot. "Do it right. We'll still be here. We'll wait," and it's tempting to just let things slip. But that's really not OK. If you're doing something cutting edge, you're making fundamental decisions about your architecture, and if you let it slide for a year or two, then it's just not the right decision anymore. Even if you pile on all these extras, it's not optimal. It's not targeted at what you're doing. So I have some concerns about Prey coming out this late.

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Hook: That's the other thing that differentiates the really good people and is sort of a pet peeve of mine. I have a problem with some of Dave Perry's attitudes, but he has shipped games, so he is someone to be taken seriously. It bothers me when someone solicits magazine covers 12 months before their game is going to ship. It's like, "Spend more time working on your game instead of hyping it." The ability to ship a game, you can't stress that enough. You know that Albert Einstein quote "Imagination is more important than knowledge." I don't believe that anymore. I think the ability to ship a product is far more important because someone who's not very creative can have little bouts of creativity, but someone who's not very productive doesn't have a bout of productivity and ship a product. You just have to grind it out.

The problem is that it's a slippery slope. Everybody likes to make fun of Battle Cruiser 3000 AD–which I've never even seen–but it was like seven years late because they didn't know when to just say "Ship the damn thing!" No matter how creative you are, no matter how good you are, if your product takes three, four, five years to develop, you're not going to make back the money you spent on development.

These days, I'm a lot more jaded. You'll see Next Generation or boot coming out with a preview of a game that's 25% complete but it's got the most incredible screen shots. You look at it, and you look at the developer, and you're like "What have they done? Nothing." You can look at a laundry list of games that people talked about and never shipped, or by the time they came out, were absolutely irrelevant.

John Carmack: We've got a pretty consistent track record here. We go 50% over budget on schedules. With Quake we said "We're going to do it in 12 months," it took 18. It's pretty much the same thing back for Doom and Wolf. Michael Abrash and I once had a discussion kind of justifying ourselves. We said, "Well, if we shipped on time, we probably weren't ambitious enough."

Hook: Games that were started in 1992 and took a really long time have shipped in the past six months and they still use fixed-point math. And fix-point math died with the 486. They said "Hey, why don't we use floating point?" Then later, it's, "No, we don't have time to go back and rewrite it." You choose your target platform and you architect your entire game

around this concept, then the minute you slip you're going to be dated technology and you're not going to be appropriate for the vast majority of systems people are running.

John Carmack: That was one thing that Quake did really good on. We still hear people that use Cyrix and AMD processors saying, "You're just lazy for not doing fixed-point math." We saved time doing floating point. And on Intel processors it was actually the faster thing to do.

Chapter 4

John Carmack (of id Software) interview

This interview was conducted by Electric Play for Electric Play on Dec 06, 1997.

Interview

Electric Play: Does this stuff make you kind of uncomfortable, all of this attention.

John Carmack: Well, I usually try to avoid press whenever possible because all of my time is really spent on my work and I would much rather be working on something new than talking about something I did in the past. I try to only manage to do a couple of these a year and hide from most of the rest of them.

Electric Play: You must realize that everybody is interested in where you came from and why you got into games.

John Carmack: I know it's a pretty good story, but once again it's not

getting into it for the fame and talking about it wasn't in my plans.

Electric Play: Having said that, how did you get started in the games industry.

John Carmack: I've always thought of myself as a games programmer with the programmer emphasized. Working with computers has been something that has fascinated me since I first worked on a computer with, like an Apple II in sixth grade. From that point on, I knew that I was going to be a computer programmer, it was just a forgone conclusion, and it was only a matter of the years going by until it came to be time that I could do that as my full-time profession. I knew for a decade before I could actually go out and do it as my job.

Electric Play: Was it games specifically that interested you?

John Carmack: Just about anything I could find interesting. I enjoy writing compilers or interpreters or network sub-systems. There are interesting aspects to all of these, but games have turned out to be a nice place where a synthesis of these interesting things can be done and it can be a lucrative rewarding profession. So instead of being pigeon-holed in one area, I get to work on just all sorts of different technologies and it has been just about the best possible thing for me.

Early on there was a little bit of concern that I might get bored with the games and go off and work on something else, OS research or something, but as the years have gone by I've found that I've been able to do probably more stuff in this field than I would have in any other field of computer science. I'm quite happy with it.

Electric Play: Are you a game player yourself?

John Carmack: Yeah, I've played quite a bit. It comes and goes depending on different phases of the development process. At the peak I guess I would play Quake at maybe half an hour or an hour a day, but right now it's kind of low because we are heading in towards crunch time on Quake 2. I haven't played in a little while.

Electric Play: When did it hit you that you'd created something that was going to bring you a lot of attention?

John Carmack: Well, with the early projects we were just so excited to do anything at all. Our early side-scrolling games, we'd find something neat that we'd be able to do. We'd be able to emulate some of the games that we enjoyed and liked and try them for the first time on the PC. That was when it was all just exciting for us to be doing it at all We were just pleased that we were able to be getting anything out there.

As we moved into the 3D games with Wolfenstien 3D it became obvious that we were kind of on the verge of... well, we basically invented a whole new genre of games; the first person action shooter. That was pretty obvious from the first project, and as we moved into Doom it did become clear that we had carved out a niche pretty much permanently for ourselves. We've been pursuing that and flushing it out and seeing where it takes us as we ride the different technologies that are going on.

Electric Play: You guys have been at the forefront of that stuff and also the distribution model that has blown the industry away with the shareware versions.

John Carmack: Well, I would have to say.. I know that Apogee always comes out and they are correct in saying that wasn't our model, that was Apogee's model. We were just kind of the most famous for probably the way Doom was distributed originally, but that was Scott Miller's idea and our early products were distributed by Apogee. It was basically their method. It was a really smart business model and it did really well for boot-strapping some small companies and development teams.

Electric Play: Is developing the 3D games pretty much the same now as it was back then?

John Carmack: It has gotten a lot rougher. If you look at the way our games have gone, early on, our first couple of games only took three months of time to develop, then maybe four months. Wolfenstein took six months. Doom took nine. Doom II took 12 and Quake took 18. Quake II is only going to take 12 months because a lot of things are functioning better at the company.

There is a definite fear that the next generational step that we take... if it is a two year development process, that is starting to bring up a lot of complicated issues. How do you forecast two years ahead and what

technology curves that you are going to be riding? It has gotten a lot more difficult.

The market has changed quite a bit too. It's not even clear that a game like Tetris or something could be successful in today's market. So there are much larger barriers to entry.

Electric Play: Are you worried that there is a little bit of over-saturation with first person shooters out there?

John Carmack: It does concern me a little bit, not so much for our position because I do believe we will lead the crowd pretty consistently, but with all of the people working with the technology, I mean we are fairly widely licensing our technology and there are several good companies that are going to do good products with it, but there is a limit to how much the market can sustain out of that.

Electric Play: What are some of the other companies and other games that are using the Quake engine?

John Carmack: Well there are about a half-dozen games that are under development directly with the Quake technology. There are a couple at ION Storm, there is the one at Ritual, SIN. 3D Realms is doing one. Valve is doing one. There are a couple of other licensees out there, and there are options for more, and there will probably be more later on. So there is a lot of action going on, though while it sounds like a lot it is still the sensible thing for those companies to be doing.

Developing the technology, if they pay a whole lot of money to us for that, they could have looked at it and said 'maybe we could hire a few guys and re-develop it for ourselves for less and even get some additional features'. But time is so crucial on game development. If you say 'well we are going to do it in nine months' which is half of what we did it in. If you've got a model to work from and you are just re-engineering, it might not be out of the question to do that. But still, nine months is just a huge amount of time. For most companies it is easier to throw off a half million dollars or something rather than spending nine months of time. It is usually the smart business move.

Electric Play: What do you say to guys like Dave Perry of Shiny Entertain-

ment who are saying that a game company developing its own technology is absolutely crucial to good game development.

John Carmack: I think that the people who create their own technology and produce the games will always be at the head of the pack and you are definitely better off there. But the bottom line is that there are only a handful of companies that are capable of doing it, even given all of the right conditions. It gets narrowed down by the fact that the conditions are not always there.

I think that he is absolutely correct in the sense that if you have the resources, all of the resources necessary to do it, you are definitely better off. An engine that is custom designed specifically for your game will certainly be better adapted to it, but there are so many different resources that are required for it. There is the time, at least a year, for development of the technology. There is the integration of all of that. There are only a handful of programmers in the world that can compete at the top level of this now. Companies that don't have those programmers try to grow them from people that they've got. It's all possible but it keeps adding these levels of risk to it. The companies that are able to produce the technologies specifically for their own games, if the technology is state of the art they will lead the pack.

I think that is clearly his mission and I think that Shiny is taking pretty much the right steps to play in that ballpark, so I think he is correct.

Electric Play: I'm curious to find out what your views are on the way that the Dallas development pool sprang. How did you end up in Dallas?

John Carmack: Well, originally we pretty much came down here around Apogee, but there is kind of a funny story there, in that when id was first founded we were in Louisiana and Apogee was distributing our work.

We moved the company in a fairly misguided moment to Madison, Wisconsin. It was a horrible mistake and we fled south and just knew we were going someplace where it was warm. The obvious place we were considering was down here by our distributor. There were a few other factors that got tossed in so we just moved down here. It has worked out pretty well. And then all of these other companies kind of sprang up, people falling off or breaking away from Apogee or id into the half dozen other

companies that are here. There are a couple of other unrelated companies in the Dallas area. It is a surprisingly active game development scene here. No one would have guessed it in the middle of Texas a few years ago.

Electric Play: Do you think that it is growing?

John Carmack: It certainly is growing a lot right now. I'm not clear that it can be sustained over the longer term, but for the next year or two we will see quite a bit going on.

Electric Play: Now John Romero, who is one of the founders of ION Storm, was a key member of id. What was that like when he decided to say 'I'm leaving guys' and started his own company.

John Carmack: That is not really the way things happened. Romero is an extremely talented person and he was crucial to the early success of id. Very much his mark is on Doom, Doom 1, a lot of it has his spirit in it. He was a key player in all of our projects up to that point, but there were some serious problems afterwards.

We are a very focused company where we require everyone to work an awful lot. I mean we don't believe in letting people direct other people to do the real hard work and allow themselves to work in a less focused fashion.

The bottom line came to be that Romero had reached his level of success and he wasn't pushing as hard as everyone else was and.. he'd... we pretty much.. well, we fired him. We parted on reasonably good terms. We are technology licensing with him. We still talk every now and then, but he just wasn't working out as a part of id. His new company seems to be what he wants it to be, where he has got a large number of people that he can direct and he can give his ideas to for implementation. We'll see if it works out well with him.

Electric Play: Switching tracks a bit, what is new with Quake II? How is it going to be different from the original Quake?

John Carmack: Well it is still an evolutionary product where it is not a brand new technology generation, but it is the largest evolutionary step we've taken.

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In our previous products we've always done kind of a follow-on that was basically identical technology but with new content as an opportunity for the designers to kind of stretch themselves with known constraints. The first product with a bleeding edge technology is a really hard thing for the designers to work on, it's very frustrating because with all of the work that they put into it, the technology will change and the rug will get pulled out from underneath their feet and they will have to throw away stuff. Things that they were planning on don't make it in.

It's just tough in the bleeding edge products. Usually in the follow-on is where they get known circumstances and can stretch their design skills and do things that are better for games. With Quake especially we were hit hard with all of those factors. We were having problems with Romero and some of our other employees and the whole company wasn't really working very well through Quake's development. It had many serious design problems but we just had to push it out the door. We knew that it wasn't really hitting the potential that it should have even for a first generation product. So we had plenty of room to improve Quake II.

At this time we have the best crew that we've ever had at id. Every single person is really essential to the company right now. We are all working very hard. Quake II is going to be our best game in any way that you want to look at it. It has the best design. It has flexible integrated technology. There is a sense of purpose and elegance to the entire design and it has come together very cleanly.

There is not like.. 'gee wiz' incredibly unbelievable features, but there is a solid evolution. Everything that was good in Quake we've made better. All of the things that were lacking in Quake are now present. We have a good design. We have flow through the levels. We have intelligent presentation of new features and monsters. We do have new rendering features, a lot of things that people look for like colored lighting, translucency, and other effects like that. Different ways for model interpolation. There are a lot of nice features to make people say 'Wow this is a souped up engine', but it is still fundamentally the same generation.

I know what the next generation is going to look like and this isn't it. This will be the state of the art for the next year as other things are built on top of it. The main thing that we are looking at with Quake II is that it is going

to be a better game because we fell below our own par on Quake and we don't intend to repeat that again.

Electric Play: Is multiplayer gaming it? Is it something that you guys consider necessary?

John Carmack: Multiplayer gaming is the most exciting part of the gaming industry. If you are being rational, it's still not enough to support the games industry. If you are paying attention on the net you can get a self-centered of reality thinking that there are fifty-thousand people that are stark raving lunatics about it and that's all that matters, but you forget that there are a million people that are just buying the game for the single player stuff. But the multiplayer is far and away the most exciting and that is where a lot of the interesting things are happening with the online community.

There have been a lot of things that have been designed into Quake II from a technology standpoint to allow some really interesting things to happen. Like we have effectively no limit on the number of players that can be in a large multiplayer world. I fully expect to see at some convention, like at QuakeCon '98 we'll see 150 people in one giantic specially constructed map. There are some really exciting things happening.

Electric Play: Is that what excites you the most?

John Carmack: There are so many things that excite me about what I work on here. The multiplayer aspect has a lot of challenging problems on dealing with the communications of that many seperate clients. Dealing with the bandwidth and latency issues.

The other thing that I'm really excited about is the next generation graphics technology, I have a fairly clear vision of several steps that we are taking there and that is going to be a lot of fun.

Electric Play: In the graphics side, there are artists and lead artists that oversee...

John Carmack: We don't really have an arrangement like that. We have three artists and they all kind of overlap. Paul Steed is strictly a modeller, Adrian is strictly a texturer and Kevin kind of covers those and can work on either side, but there is not a type of lead artist.

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We don't have enough staff to require a level of management like that which I think is kind of an inherent inefficiency if you do require it, because then you have someone who is busy managing instead of doing. That is actually a significant issue about id, where we don't believe in getting to a level where you need managers. I mean we have 11 people working on a project right now and it's unlikely going to grow significantly over this. We think that is the right number of people to do a project like this and having 50 people doesn't help, in fact it hurts.

Electric Play: How do you make your direction decisions? Do you get together and have democratic meetings?

John Carmack: Well, it is a helluva lot better now with less people. At one point id had six people that were partial owners in one way or another, now it is down to three and life runs so much more smoothly. I don't believe in commitee and democratic votes. Whenever possible a dictatorship is the most efficient form of government.

Electric Play: Are you hands on with everything, all of the programming and the coding that goes on in Quake II.

John Carmack: Almost all of my time is spent actually coding stuff for the game. Quake II is the first time that I haven't needed to be involved in the rest of the project which has been really nice for me.

Kevin Cloud has taken over as project manager to make sure that the levels and art and monsters and all of those things are done and coordinated. Previously I always had to make an effort to make sure that it got done, but it has worked out nicely without that. So my duties now are strictly to make sure that the code works right and to keep anything really obnoxious from slipping through. I mean I'm kind of a final filter of things because if I don't think something is good enough that I'm not going to program it in and it's not going to be in there.

I've had to do nothing outside of coding on Quake II which has been a real change for me. But certainly all of the code, every file is practically created by me. I share a lot of work now with Brian Hook and John Cash which has been really nice. We have it pretty segmented out.

John Cash has been doing a lot of game programming with making the

monsters perform their actions and artificial intelligence. He is doing an excellent job segmented off there.

Brian Hook has been brought on to help me with supporting the different graphics, the different 3D accelerators, different graphics architectures. I start everything and then I parcel some of it out to the other people and that has worked out really efficiently for us.

Electric Play: And that is why Quake II is going to be so much more cleaner?

John Carmack: Well all of the projects have been done like that. This probably has more code written by other people just because we have a better way to split it out. On Quake there was really only two of us that wrote code, me and Michael Abrash. Michael was doing mostly assembly optimizations on things. So we have more people writing a somewhat larger bulk of code now, but we have made changes to our structure to allow us to work a little bit more independantly.

Electric Play: You mentioned that Quake II is not the next generation and that you know what that will look like. What is the next level?

John Carmack: Well the fundamental challenge of the next generation of games is going to be dynamic generation of flexible geometry so that you can have levels of detail issues... where Quake's geometry is fixed and immutable. So if you can see a huge canyon, every polygon that you can see there is going to be drawn as a little spec and as you get closer to it, it becomes a great big polygon.

For certain types of things that is the way to do it, like for a desk because that geometry is inherently flat, but if you want to model something natural like trees, rivers, hills, and mountains. With things like that you want dynamic geometry where as you get further away it simplifies itself down.

That can be applied to all levels of things, where everything should be able to fall down at some point to a simplified representation so that you can render anything. There are levels of steps that are going to be taken to approach this. I've got a pretty good idea where we are going with our next generation of technology and dynamic geometry is the most key element. I think everybody recognizes that is the future, but the issues of

how you are actually going to bring that into the future is really crucial.

Some of the other important things are atmospheric effects, like real fog that illuminates in light tones and rolls around the feet, not just this haze that you use as an excuse for a rear clipping plane the way people do it now. There will be a lot of specular lighting which is a second pass, which people aren't doing now but as accellerators get faster and we can afford to do an extra pass.

There will be a lot of stuff that you will see immediatly with the next generation. You will see the atmosphere affect the light and as you move you will see changing specular highlights. You will have scenes that you just can't do with current generation technology, which is what technology is supposed to do, to allow you to do things you haven't done before.

Now if you want to be able to stand on top of a castle and see the whole world spread out before you which you just can't do with any kind of current technology but it is going to be possible with the next generation so that will change the types of games that we have available for us to do.

The way we work our games here is that, instead of making desgin documents and saying this is the kind of game we want to make and then trying to do the technology... instead we try to figure out the most impressive technology that will have the biggest impact on the players and then mold a game around that. That has affected a lot of our choices because the technologies that we've been developing that I consider as the most impressive aren't able to do grand outdoor areas. That is why we aren't doing flying or driving games or something like that. But the densly enclosed areas with detailed textures and complex lighting that you can do can have a very evocative feel on the players and we can get a lot of pulse pounding action out of it. In the next generation we won't leave that behind, but we will have these new areas that we can design a game that brings more elements into it than we had before.

Chapter 5

Interview with John Carmack

This interview was conducted by Benjamin E. Sones for Computer Games Online on Jun 30, 1999.

Interview

Prologue

Other staff members have come and gone since the unofficial genesis of id Software in September of 1990. From the original four founders (John Carmack, Adrian Carmack, John Romero, and Tom Hall) who came together to create both id and the Commander Keen series, the company has grown only slightly in size -14 members currently fill the roles of the id staff. Their technological prowess and influence within the computer game industry have grown immeasurably, however, and now the powerhouse developer is working full steam to deliver their next first-person shooter. We cornered founder and lead programmer John Carmack in the halls of id's Mesquite, Texas offices to gather his thoughts on Quake

III Arena.

Questions

Benjamin E. Sones: What are you most excited about in regards to Quake III Arena?

John Carmack: Well, one of the things is that because of the way the development schedule has gone this time, I've had a lot more time to make a lot of the technology really "well done" and robust. It's turned out that the game engine is not the leading factor in this project. Right now the leading factor is getting the bots and the single-player experience going. So that's really given me more room than I usually have to go in and make sure that everything not only works, but actually is pretty much doing the right thing and it's giving us a more flexible infrastructure to go for, which means that other companies that wind up working with the technology, and all the user community stuff is going to work out, and yet again be more flexible than anything that's been done before. I know that's not going to have any immediate impact, but as we look towards six months after release, or twelve months after release, that's where those things are really going to shine through.

Benjamin E. Sones: Will this game cater to the mod community to the same extent as your past projects have?

John Carmack: Ever since Wolfenstein that's been one of my primary design goals-to go ahead and make something that's going to be flexible and easy to add on and play with in different ways, because one of the things is, all game designs are elements of compromise. We have to go ahead and make certain rules that we think are going to be right for what we're doing but it really is something I like a whole lot, the fact that it is fairly straightforward for people to go in and change the game to suit themselves. I think that's a good thing. In some ways there's definitely a lot more flexibility than we've had before. Whether or not it will be easier or more difficult to take advantage of, I'm not sure yet. There is more that people have to think about in a few ways, because we have modifications being done on the client side as well as the server side. But it's definitely

way more powerful, and it doesn't require a commercial compiler to go ahead and do the work with.

When we did Quake II there was kind of this dividing point where going to .DLLs lets you do much more advanced things, and it brought out things that you never would have been able to do in Quake with QC, but it did mean that you pretty much had to be pretty much a professional programmer with professional development tools and everything to work with it. Now we can use a freely available compiler for [Quake III Arena] that will be available to anyone and allow anyone to work with that. All in all, Quake II mods definitely did come out, and it was almost certainly for the best-we got more sophisticated mods with more development work. There was less of "here's my mods that will make more gibs" that we got with Quake, where everyone can just go in and do their ten line modification. That was cool because it did get a lot of people more interested in programming but it just wasn't a professional enough development environment to do some really major modifications. People did go ahead and bump right up against the limits of what you could do with Quake II, and those are the people who are going to be thrilled with what you get with Quake III. You actually can go ahead and build an entirely new user interface and complete client-side presentation. We've got an extremely elegant, orthogonal graphics engine that people can work with, our shading language is really great.

Really, Quake III-our game-isn't going to exploit most of the things we've got in terms of graphics. We've made a pretty specific design decision to focus on the fast action stuff. Speed is one of the most important factors in what we're doing right now. I do expect that other companies working with the technology-and even with mods-there's going to be people that do some really, really, neat things. As we [are developing] the technology, right now our artists are just getting into the swing of building procedural shader stuff and everything like that, but we can't go back and rework everything. Honestly, that's something that I'm a little bit disappointed with we have a bunch of technology in [the engine] that we aren't exploiting properly yet. We've got things like specular maps and detail maps, and these things just aren't in any of the levels. A lot of that does come back to the speed thing-people will put one of these things in at some place, and then they go over their polygon budget and they have to pull it back

out.

All the mainstays of id Software products we do have-the best graphics stuff, the best networking, and I think it's going to have the best gameplay. It comes down to some design decisions, and I am happy with the ones we've made. We have been focusing on a general, broad appeal. There are a lot of more sophisticated games that you can make that will appeal very strongly to the people that are more serious about some things, and I think that games like Team Fortress 2 will fall into this [category]. The people that will be into that kind of gameplay will love it-they will love it more than they will love Quake III, but there's a larger base of people who just want to sit down and have some idle entertainment. I still immensely pleased that our secretary is addicted to Quake III Arena] now. She's been here since Doom, but this is the first game that she has started playing every day, and I think that's a real winning thing. We have also catered to the other side, the real hardcore tournament player that we are making a lot of design decisions around. Like the fact that you can configure Quake III to run as fast as Quake II if you're willing to have it look like crap. [Laughs]. That's just a level of flexibility that will be up to the user to decide.

Benjamin E. Sones: More than one id employee has made the comparison between Quake III Arena and fighting games such as Mortal Kombat is that a valid assessment of Quake III's gameplay?

John Carmack: Not really, because we're not focused on one-on-one or head-to-head. Tournament play will be like that, but most of the maps-900f them-are designed for 4 or more players. Being in there with at least small teams or a larger number of people in a free-for-all that is more the flavor of the game. We do scale kind of both ways, to one-on-one and also to the much larger games, but we've kind of looked at our sweet spot being in the 4 to 8 player range. That's the type of pick-up deathmatch games that I most enjoy playing, where you've got a reasonable number of people running around. It's a different game than the "cat and mouse" of head-to-head. Those are just pure judgement calls, there are other valid game styles to be had. In general the game is not about the one-on-one [gameplay] like fighting games are.

Benjamin E. Sones: But not as much about story, either?

CHAPTER 5. INTERVIEW WITH JOHN CARMACK

John Carmack: No, not at all. We're still all about the experience of the combat in that way, yes, it is very much like the fighting games where there is some back story, but who the hell cares? The game has to be fun as you're doing your actions, as you're sitting there doing your "bob and weave," "duck and attack" that's what has to be fun-not the fact that you are progressing through a story to some end goal. That's something that I'm making no excuses about, no slipping around saying "Oh, there is a story" and all that. Yes, there is a little back-story, but that's not the point. The point is that the game is fun to play. There's value to be had in story-driven games-it's another valid style. It's not like we're saying "this is the only way to do games;" but one thing we absolutely are coming out and saying is that this is a valid way of doing games, and we are not apologizing for the lack of story.

Benjamin E. Sones: Some people have said that is one of id's strengths is Quake III Arena an attempt to strip away the non-essentials and focus on what you are best at?

John Carmack: Absolutely. I wanted to do this in Quake, where the last month somebody writes up a story for it-"blah blah blah,"-and I just wanted to say "whatever it's not the point." I would rather not attempt to do something when I know we're going to do a slipshod job at it.

Benjamin E. Sones: Was balancing weapons towards deathmatch a major issue in this game?

John Carmack: The major issue in designing weapons for single-player is that in single-player you have to start off with a pea shooter, because the weapons are the major cookies that you get as you go along. Your character gets bigger and more powerful by getting bigger and more powerful offensive capabilities. In single-player it's not as rewarding to get a weapon that has a different tactical benefit; you want to be able to just impart massive destruction. You just need to be able to go in and lay waste to everything. That is what gives you the good feedback, [that is] the "treasure" in single-player. That's not what you want in multiplayer. We've got one weapon that is the "massive devastation" weapon, and a lot of people will hate that it's in there when they get killed by it but a lot of that is the fact that people will argue about anything.

There is something to be said for the argument, what a lot of the Quake

players said about Quake II was that they thought the weapons were too balanced. Different people could have fair fights with multiple different weapons, and we generally thought that was a positive step. In Quake everyone liked the rocket launcher, and people with good framerates and good connections liked the lightning gun. That was basically it-nobody cared about the nailgun and the single shotgun they might as well have not even been there. We're still of the opinion that we would rather have more weapons that tend to be effective, but there is a little bit more spread between them [in Quake III Arena]. In some cases you come down to different styles of games, where some people like a style of game that just isn't what we're making.

A lot of people in Quake liked the kind of "blow out" matches where you get control of the level, and it's not even a matter of fair fights, it's just a matter of maintaining your dominance, and you get scores of 50 to 1. Some people really enjoy that, but I don't think that in general that is a fun game for most people. We have tried to build in changes that prevent that from happening. A perfect game is where the relative rankings of players is proportional to their skill, and Quake was not terribly balanced like that. You would have somebody, who was definitely better, but they would just completely wipe the floor with somebody who was only a little bit worse than them, and we don't feel that offers a real good sense of proportional advancement. You still want a game that's fair, where the better players always wins, but you don't want it to be completely demoralizing to the person who gets really close, but just doesn't quite get into that niche.

Benjamin E. Sones: Tell us about the single-player game.

John Carmack: I'm really happy with the elements of the single-player game where there are two axes that you're advancing on-you have the opening up of new levels, and then you have your relative ranking to all the bots in the game. That has some nice feedback characteristics to it where if you're going in and you're not that great at the game-you just don't have massively wonderful reflexes-you will get in and reach your plateau, and the game will keep putting in relatively appropriate bots for you. Even if you've plateaued and reached the extent of your skills, if you keep going at it, you will eventually get to see all the levels. Even if you reach a level that you really are no good at, if you keep losing your rank

will eventually start to go down, and if you do that long enough eventually the game will put in the bots that essentially stand still and let you shoot them. Persistence will get you through the game, if you are having fun. There is also the other axis, where even if you don't care about seeing all the levels and you want to fight to hone your skills, you can pick your favorite level and just keep playing on that until you work your rank up above all the other bots. I think that's a really nice thing, because in all of our games-since way back when-there has been this demoralizing aspect that even though we make 30 levels of the game, most players never see all those levels. Each level takes the same amount of time to create, we've got designers making things and putting all this effort into making things that most people will never see. I don't have any hard numbers to back it up, but I would bet that only a minority of people played through all the levels in Quake II.

Benjamin E. Sones: Are there any incentives built into the single-player game that give the player reason to play all the way through, or do you feel that it is not even an issue?

John Carmack: Seeing new levels-that is a reward, to open up and see new environments to play in, and seeing new models for the enemy bot characters. We have ranking awards as that kind of cookie thing that we present, and I am really happy with the reward things we've got like the "impressives" and "excellents" that you get while you're playing the game that was a perfect thing to add because it brings a smile to everyone's face every time it happens, and it's not taking something away from other players. It's a really great game design aspect, because if you give the player a cooler weapon it takes something away from the other player-they get killed more easily, and it's more frustrating for them. But it's a free cookie when you can give something away like [verbal accolades], because the other player is already dead. We've tried a few things like that, but we haven't come across many that are worthwhile-the "impressives" for accurate railgun hits and the "excellents" for multiple deaths within a short amount of time we think those have stood really well. We're going to track all of those, and in the single-player game you will get little merit badge-type things to track your achievement there. If you've been playing the game a long time you can have a big row of awards like that.

Benjamin E. Sones: Will there be a ranking system in the multiplayer

game?

John Carmack: No. We considered doing that, and in my original Quake-world experimentation I had global ranking on everything, and it was a really interesting issue because that split the community almost down the middle. There were people that like it and thought it was a great idea, and the other half thought it took away from the game, and there were valid arguments for that too. There were behaviors you would start seeing from people where, a lot of time when you are playing on servers you're kind of just goofing off, having a good time, trying goofy stuff or just playing casually with you friends. When every frag was logged, people got a lot less friendly. You'd see people who would abort out of games they saw somebody tough enter the game, because they didn't want to risk having a fair fight. There was a lot more whining and complaining. The right way to do it would be to have it optional, where servers would be logged or not. As soon as you're into people setting up their own servers with their own rule modifications, it's just a huge can of worms. I would rather allow more diversity to happen by just allowing people to change the rules on their servers and run modifications and things like that, rather than to have it be "here is the game, in crystallized form, which we are going to be ranking people on." I think there are going to be servers that have rankings for just the people who play on those servers. You're not going to be able to say "I'm the best player in the world" there is definitely value to that, but what it would take away from the community as a whole, it's just a non-optable thing.

Chapter 6

Carmack Q&A on Q3A changes

This interview was conducted by Kenn Hwang for Firing Squad on Sep 28, 1999.

Interview

Prologue

John Carmack's recent .plan update included some exciting news for Quake 3 Arena players, consisting of gameplay changes, bug fixes, and more. In response to the sometimes technical-sounding worklog, we shot off a few questions to JC to get the straight scoop on what's been done.

Questions

Kenn Hwang: In your recent plan, you mentioned that com_maxfps has been limited to 85. Were there still high-framerate problems that were

cropping up at 100fps?

John Carmack: Yes. Some poor modem connections still had problems.

Kenn Hwang: Do you think this will be detrimental to people planning on buying new video cards capable of putting out twice the framerate (particularly at low detail settings)? For advanced players, more FPS makes a huge difference (being able to see and dodge fast-moving projectiles such as the hyperblaster, plasmagun, etc.).

John Carmack: You are free to turn off com_maxfps if you want, the default is just a safe level.

Kenn Hwang: How will you fix low-fps problems such as the no-fall telelport (from the lightning room into the RL room) in q3tourney? How hard is it to fix the source of the problem (bugs occuring due to different framerates), rather than applying kludges such as arbitrary framerate limits?

John Carmack: The way to make everything completely framerate independent is to use fixed timeslices for simulation, but that comflicts with trying to get very high framerates. DOOM used a fixed 35 hz simulation cycle, so it never varied at different speeds, but it could never run faster than 35 hz.

Quake has always used a msec variable simulation time, which allows any framerates without stuttering, but has some time dependent behavior.

In theory, all itterative behavior can be calculated parametrically at arbitrary times, but in practice there are difficulties.

I just added a maximum simulation time option, which subdivides frames larger than 66 msec into two moves, which prevents large changes in behavior.

This fixes the no-fall exploit.

The simulation timeslice is definately a tradeoff – the smaller it is, the less variation is allowed, but it involves more cpu work, which can make it go even slower, feeding in upon itself.

Kenn Hwang: You also mentioned "removing some latency from light-

ning endpoint." Could you give us a little more detail on this? Is it the slight delay between shooting and hitting sound effects, or how the shaft appears onscreen?

John Carmack: The amount of lag when turning has been slightly (average 25 ms) reduced.

Kenn Hwang: Currently in 1.08, walking backwards is still fast enough to produce footstep sounds. Will this be fixed?

John Carmack: I had forgotten about that. I just fixed it. Anything else on the firing squad's "annoying bugs in q3test" list?

Kenn Hwang: PS - I'm going to ask for Dennis since he'll never ask himself - what are the chances of getting footsteps reduced/removed for 1 on 1? :)

John Carmack: We had them out for a while, but we put them back in because the levels felt more "dead" without player movement noises.

Chapter 7

Carmack responds to FS Suggestions

This interview was conducted by Kenn Hwang for Firing Squad on Oct 02, 1999.

http://www.firingsquad.com/news/newsarticle.asp?searchid=832

Interview

Prologue

A few days ago, we sent off an e-mail to John Carmack outlining some further bugs and broken features in Q3A test. Let's just say the man is on top of things! Here is the latest exchange we've had with him, and the results they've produced!

Questions

Kenn Hwang: Hey John, Thanks a lot for being so quick to answer our questions! We got deluged with "bug fix" mail, and here are the few that we felt relevent to the game as it's developing. Scoring: Currently, if 3 people are tied for first, the 4th person down still registers as being in "2nd place" even though they may be significantly lower in frag-count than the ones above.

John Carmack: Ok, changed it. I got the selectable crosshairs and crosshair offsets Dennis requested in, and most of the things you mention.

Kenn Hwang: Many people wrote in about racing someone to a weapon and hearing the pickup, only to find that the client-side predict was off by a fraction of a second, so they actually didn't pick it up. This never happened on any other id game, and we experience it regularly even on LAN. Is this something that can be fixed?

John Carmack: I added a "cg_predictItems 0" option if you don't want predicted pickups, but I like them when playing online.

Kenn Hwang: cg_drawFPS doesn't work in teamplay. Taking out cg_drawtimer is a good thing, but FPS is harmless and people love seeing their framerate.

John Carmack: All status elements now stack above/below each other as apropriate instead of overriding or overdrawing each other. Cg_drawtimer is NOT explicitly removed now. I understand how it is used in timing items, but I don't think it would be right to remove it from a specific mode of play.

Kenn Hwang: Currently, switching teams in teamplay mode subtracts one frag from the team. This even happens if players are going into spectator mode. Is it possible just to make players spawn into spectator mode and allow them to select their team?

John Carmack: Done.

Kenn Hwang: You mentioned the com_maxfps can be changed from the default of 85. Is 100 still a max limit or will people be able to choose to go

higher (and voluntarily live with the FPS-induced issues)?

John Carmack: You can set it to any number, or 0 to disable all limits.

Kenn Hwang: Here's a doozy we found while benchmarking the game with different OSs and video cards. Alpha-transparency effects such as invisibility, smoke trails, and even the crosshair vary on different cards, drivers, and OSs. While this isn't really an id issue, it does seriously affect the game because people playing in WinNT will have lighter smoke trails and crosshairs (basically what people were doing in q3test to hack their smoke). In many cases, the invisibility is virtually undetectable on certain configs while it stands out clearly in others. Can this be taken into account as the powerup features get tweaked (perhaps base part of it on a non-alpha effect)?

John Carmack: Not much we can do about that.

Kenn Hwang: Thanks a lot for your time, John. I hope you can bear another argument against footsteps :) In free for all, footsteps rarely make enough of a difference to use as a tactical advantage. However, in 1 on 1, every sound matters, and the game slows to a crawl as people walk around rooms and corners continually. Basically it comes down the fact that by standing still, you can tell where your opponent is and they can't tell where you are. 1 on 1 is such a different game, and whatever id decides WILL become the default for world competition. We're of the opinion of making it as fast and frenzied as FFA/teamplay. Would you consider turning off footsteps only for the tournament mode of gameplay? The weapons idle sounds and item pickups should be enough to keep players on their toes, and a 1 on 1 with footsteps is guaranteed to be much more "dead" and quiet compared to one without. Also, if you think about it, since sound is so important, taking out footsteps can also keep reduce bunnyhopping/strafejumping, since they'll be able to remain silent at full running speed (otherwise the convention goes "why should I run and make footstep sounds when I can go faster by bunnyhopping?") Thanks again, and sorry for the constant badgering!

John Carmack: I have been thinking hard about that. I see your points, and they make sense, but we just added a bunch of character specific footsteps, and for non-professional gamers, we think they add to the experience.

CHAPTER 7. CARMACK RESPONDS TO FS SUGGESTIONS

If there were a small set of professional rules that I agree with in theory but have chosen not to pursue because they conflict with more common play, then an official "pro mode" might make sense. Any other suggestions along those lines?

Kenn Hwang: Well, for better or for worse, the fact that id is willing to consider a "professional" mode to suite the smaller elite community is an tremendous step forward! Remember, if this does get implemented, it wil consist only of small changes and minor tweaks, and will most likely consist of hard-set (or suggested) values for team/tournament play, such as ammo, footsteps, minor weapons tweakage, and such. Thanks for listening to our pleas, John!

Chapter 8

Slashdot asks, John Carmack Answers

This interview was conducted by Slashdot for Slashdot on Oct 15, 1999.

http://games.slashdot.org/article.pl?sid=99/10/15/1012230

Interview

Prologue

A few days past, we solicited questions from you folks to ask QuakeLaird John Carmack. We sent the questions over to him, and he answered. A lot. It's definitely one of the best interviews we've had yet - click below to read more.

Questions

Slashdot: Inazuma asks: I know that you and id are doing simultaneous development of Q3 for Windows, Mac and Linux. Which of those is your favorite OS to use, and which to program for?

John Carmack: I use WinNT, Win98, MacOS 8.x, and linux on a regular basis. I also spend some time with MacOS X and irix.

There are individual pros and cons to each system, but if I had to choose only a single platform in its currently shipping state to work on for the next year, I would choose WinNT.

I'm going to risk my neck here and actually defend microsoft a bit:

There are plenty of reasons to have issues with MS, but to just make a blanket statement like "everything that comes from microsoft is crap" is just not rational. There are a lot of smart people at microsoft, and they sometimes produce some nice things. There are some damn useful features of MSDEV that I have not seen on any other platform - all the intellisense pop up information and edit-and-continue, for instance.

I chose NT as our development environment because, after evaluating all available platforms, I decided it was the best tool for the job. NT had the added advantage of running the native executables of our largest target market, but the important point is that it would have won on its own merits even without it.

It offered quality 3D acceleration on intergraph hardware, a stable platform, a good user environment, apps for basics like mail and document editing as well as high end media creation tools, and a good development environment.

I made that decision over three years ago, and I think it has proven to be the correct one. NT is definitely going to be the primary development platform for our next project, but I will be evaluating alternatives for a possible transition after that. The contenders will be linux and MacOS X. None of the other unix workstations would be competitive for our purposes, and I don't think BeOS will offer anything compelling enough (they can always prove me wrong?).

I haven't really been using Win2K, but from a cursory glance, it looks like a reasonable evolution over NT 4.0. The only real downsides to NT 4.0 for me are the bad sound latency and poor input fidelity, and these should be fixed in Win2K.

The current MacOS X server is a bit of a disappointment. I really enjoyed NEXTSTEP on a lot of levels, and if it had workstation quality 3D acceleration, I probably would have stayed there. Unfortunately, much of the development effort spent on it during its transformation to MacOS X seems to be steps sideways instead of forward. Macifying the user interface, porting to PPC, deprecating ObjC for java and C++, etc. They probably all had to be done, but it just hasn't brought anything new to the table. As a user environment, it still feels sluggish, and it still doesn't have 3D graphics.

Linux has progressed a lot in usability in the time since I made the last platform decision. Sure, the guts have always been good, but the user environments were very weak compared to windows or the mac. Some people may think six xterms and a few athena apps are all the UI that anyone should need, but I disagree. The Linux user environment still isn't as good as windows, but going from redhat 5.2 to redhat 6.0 was a whole lot more impressive than going from win95 to win98, or MacOS 7 to MacOS 8. If there is another jump like that, I wouldn't feel too bad inflicting another non-windows platform on everyone else in the company.

Slashdot: DanJose52 asks: How'd you start, personally (I mean on the inside, like emotionally and morally), and how has Id software changed you? for better or worse?

John Carmack: I knew I wanted to work with computers from a very early age, but there were also a lot of other stereotypical geek aspects to my life growing up - phreaking, hacking (nobody called it "cracking" back then), rockets, bombs, and thermite (sometimes in not-so-smart combinations), sci-fi, comic books, D&D, arcades, etc.

I was sort of an amoral little jerk when I was young. I was arrogant about being smarter than other people, but unhappy that I wasn't able to spend all my time doing what I wanted. I spent a year in a juvenile home for a first offence after an evaluation by a psychologist went very badly.

I went to a couple semesters of classes at the University of Missouri (UMKC), taking nothing but CS classes, but it just didn't seem all that worthwhile. In hindsight, I could have gotten more out of it than I did, but I hadn't acquired a really good attitude towards learning from all possible sources yet.

I dropped-out of college to start programming full time, but trying to do contract programming for the Apple II/IIGS post 1990 was not a good way to make money, and I only wound up with between $1k and $2k a month. Not having enough money is stressful, and I did some things I didn't want to. I wrote a numerology program for a couple hundred bucks one time...

Softdisk publishing finally convinced me to come down to Shreveport for an interview. I had been doing contract work for Jay Wilbur and Tom Hall, so I knew there were some pretty cool people there, but meeting John Romero and Lane Roath was what convinced me to take the job. Finally meeting a couple sharp programmers that did impressive things and had more experience than I did was great.

After I took the job at Softdisk, I was happy. I was programming, or reading about programming, or talking about programming, almost every waking hour. It turned out that a $27k salary was enough that I could buy all the books and pizza that I wanted, and I had nice enough computers at work that I didn't feel the need to own more myself (4mb 386-20!).

I learned a huge amount in a short period of time, and that was probably a turning point for my personality. I could still clearly remember my state of mind when I viewed other people as being ignorant about various things, but after basically doubling my programming skills in the space of six months, I realized how relative it all was. That has been reinforced several additional times over the seven years since then.

All the time from working at Softdisk, to founding Id and making the products we are know for has been pretty seamless for me. I have been learning as much as I can, working hard, and doing my best.

I know that most people won't believe it, but a 100x increase in income really didn't have that big of an impact on me as a person. It is certainly nice to be in a position where people can't exert any leverage on you, but

it's definitely not the primary focus of my life. I get to drive a ferrari in to work, but my day to day life is almost exactly the same as it was eight years ago. I get up, go in to work, hopefully do some good stuff, then go home. I'm still happy.

Slashdot: moonboy asks: I once read, in Wired, an article that said you have an incredible headstart on everyone else for making "virtual worlds" on the Internet using your engine from the Quake games. Do you have any intention of doing this? Has anyone approached you about it? It would seem like a fantastic use of the technology with online gaming being so popular. Entire worlds online could be created virtually and very life-like with many different purposes.

John Carmack: Making Snow Crash into a reality feels like a sort of moral imperative to a lot of programmers, but the efforts that have been made so far leave a lot to be desired.

It is almost painful for me to watch some of the VRML initiatives. It just seems so obviously the wrong way to do something. All of this debating, committee forming, and spec writing, and in the end, there isn't anything to show for it. Make something really cool first, and worry about the spec after you are sure it's worth it!

I do think it is finally the right time for this to start happening for real. While a lot of people could envision the possibilities after seeing DOOM or Quake, it is really only now that we have general purpose hardware acceleration that things are actually flexible enough to be used as a creative medium without constantly being conscious of the technical limitations.

Two weeks ago, I pitched a proposal to develop some technology along these lines to the rest of the company. I may wind up working on some things like that in parallel with the next game project.

Slashdot: justin_saunders asks: Many people consider you to be one of the best programmers in the game/graphics scene, based on your ability to keep pushing the limits of current PC hardware.

I was wondering what measures you use to gauge the skill of a programmer, and who, if anyone, you look up to and consider to be a "great" programmer.

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John Carmack: Like most things, it is difficult to come up with a single weighted sum of the value of a programmer. I prefer to evaluate multiple axis independently.

Programming is really just the mundane aspect of expressing a solution to a problem. There are talents that are specifically related to actually coding, but the real issue is being able to grasp problems and devise solutions that are detailed enough to actually be coded.

Being able to clearly keep a lot of aspects of a complex system visualized is valuable.

Having a good feel for time and storage that is flexible enough to work over a range of ten orders of magnitude is valuable.

Experience is valuable.

Knowing the literature is valuable.

Being able to integrate methods and knowledge from different fields is valuable.

Being consistent is valuable.

Being creative is valuable.

Focus is extremely important. Being able to maintain focus for the length of a project gets harder and harder as schedules grow longer, but it is critical to doing great work. (Side note - every time "focus" is mentioned now, I think of Vernor Vinge's "A Deepness in the Sky", currently my favorite SF novel)

I certainly respect the abilities of my primary competitors. Back in the DOOM days, Ken Silverman was extremely impressive, and today Tim Sweeny is producing much of value.

Slashdot: ajs asks: I read a sort-of-analysis that you wrote way back comparing DirectX 3D handling to Open GL (with Open GL being far preferable to you). Do you feel that the tools that you and others will need to create the next generation of games exist now under Linux or other Open Source operating systems, or is that still a long way off? What would you recommend that we developers and developer wannabes dedicate our

time to?

John Carmack: To develop a game, you need coding tools, pixel art tools, modeling and texturing tools, sound tools, and usually music tools.

Coding tools are basically fine under linux, and there is already plenty of force behind their improvement.

Gimp looks serviceable for pixel editing, but I don't know of any professional game developers using it.

I assume there are some basic sound tools available, but I would be surprised if they are equal to the best windows or mac tools. That is probably the most approachable sector to work on improving.

Modeling and texturing tools are the biggest lack, but it is also the hardest to address. They really need to be built on top of solid 3D infrastructure, and that is still in its infancy right now. It would probably be possible to build a simple, focused modeling and texturing program that could get the job done, but full featured programs like MAX and maya have an immense amount of work invested in them. Maybe SGI will get maya ported to linux...

We are going to try to build our next level editor cross-platform, which will probably sort out a bunch of 3D content creation issues. I will be improving the matrox GLX driver as necessary to support the effort.

Slashdot: thebrit asks: Is it possible ID may join Ion Storm for a future project together, or are the 'artistic' differences between you too great?

John Carmack: Future technology licensing is certainly possible, but as for actually working together, there is very little chance of that for a project that we considered important.

If I decided to spend a little discretionary time whipping up, say, a color gameboy port of Commander Keen (an idea I have sort of been toying with), then I might ask Tom and John if they wanted to make some levels for it.

Slashdot: Scott Francis[Mecham asks: Recently someone posted about their experience in determining the file structure of the Doom WADfile. How did you feel when people were discovering how to modify Doom,

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from building new levels, to changing the executable itself(dhacked) originally without any information from id? In your opinion, is the modding community a valuable place for creating future game developers?

John Carmack: The hacking that went on in wolfenstein was unexpected, but based on that, DOOM was designed from the beginning to be modified by the user community.

The hacking that went on with the leaked alpha version was obviously not approved of, but after the official release I did start getting some specs and code out. I had sent some things out early on to a couple of the people that had done tools for wolfenstein, but in the end it was pretty much a completely different set of people that did the major work with DOOM.

The original source I released for the bsp tool was in objective-C, which wasn't the most helpful thing in the world, but it didn't take long for people to produce different tools.

Dhacked was a bit of a surprise to me, and I always looked at it as something that maybe shouldn't have been done. I'm not very fond of binary editing an executable. It clearly showed that people were interested in more control, so it probably argued for the greater freedom given with quake.

I still remember the first time I saw the original Star Wars DOOM mod. Seeing how someone had put the death star into our game felt so amazingly cool. I was so proud of what had been made possible, and I was completely sure that making games that could serve as a canvas for other people to work on was a valid direction.

A doom/quake add-on has become almost an industry standard resume component, which I think is a Very Good Thing. The best way to sell yourself is to show what you have produced, rather than tell people what you know, what you want to do, or what degrees you have.

In the modern gaming era, it is very difficult for a single person to produce a complete looking demonstration game from scratch. It does happen, but a much more reasonable scenario is to do an add-on that showcases your particular talents, whether they are in coding, design, or me-

dia. You want to be able to go to your prospective employer and say "There is a community of ten thousand people actively playing a mod that I wrote in my spare time. Give me a job and I will be able to devote all of my energy to gaming, and produce something vastly superior."

Slashdot: jflynn asks: Many people think that the extreme sucessfulness and longevity of DOOM and Quake was partly due to the internet communities that sprung up around them, to discuss playing them and write new levels for them.

How important do you feel a viable gaming community is to the success of a new game today?

John Carmack: I have always been a strong proponent of supporting the gaming community, but arguments can be made that it isn't that important for success.

Most entertainment media is designed to be throw-away, where people buy something, have a good time with it, and move on. Myst, the most successful computer game of all time, has no community.

A lot of companies would prefer to look at their games like movie releases. Every couple years, you go see the latest by a director you like, then don't think about it too much until the next one.

The game-as-a-lifestyle type of community that has sprung up around a few games is an interesting phenomenon. The plus side is that there is a lot of wonderfully creative things going on, and it does attract more attention over the years than any single media blitz.

The downside is that it breeds a lot of zealotry, which can be a bit ugly. I get some fairly hateful email from people that are too wrapped up in it and disagree with some direction I am taking.

At this point, I think it is clear that the community has been a positive thing. I was very pleased when, earlier this year, Kevin Cloud came around and agreed that the community has indeed been good for us. For years, it felt like I was just being humored by the other owners at id when I pushed for all the code releases.

Slashdot: mpav asks: This is a break from the usual questions from this

group, but I thought it would be interesting to know.. You have a couple of exotic sports cars, one being a 1000 horsepower/750 ft-lbs of torque (insane!) ferrari, and I was wondering which one you generally drive to work?

John Carmack: I drive my twin-turbo F50 almost all of the time. It took a while to get all the bugs sorted out, but it is almost a perfect combination right now. It is light, nimble, and responsive, and 600 hp at the rear wheels is just about perfect for a street car of that configuration.

I only drive my testarossa now when I am low on gas in the F50 or if I need to drive someplace where I think the extra inch or two of ground clearance is important. It is heavy and ponderous, but every time I do drive it, I am impressed again with the power. 1000 hp at the rear wheels is excessive. It takes a while to spin the turbos up to the full 24 psi of boost, but when it has a full head of steam going, it moves like nothing else on the road. It runs away from superbikes on the highway. However, when exercising it, you have a very clear sense that you are taking your life into your hands.

I will probably be getting rid of my TR when my next project car is completed. It is a custom carbon fiber bodied ferrari GTO with a one-of-a-kind billet aluminum twin turbo V12. It is going to make a bit more power than the TR, but only weigh about 2400 lbs. I have a suspicion that we will wind up detuning the engine, because 1 hp / 2 lbs is probably quite a bit past excessive and into the just-plain-stupid realm.

It was supposed to be done two years ago – mechanics are worse than programmers.

I also have a little MGB that I am theoretically working on myself, but I haven't had time to touch it in six months?

Slashdot: Hobbex asks: Though it unlikely that games will ever be free (ala beer), since so much effort goes into them from all angles (not just code, but also art, music, design etc), but that does not necessarily preclude open source game engines.

Admittedly (and I don't mean this as a slam against you) game engines today do suffer from many of the same problems that Open Source ac-

tivists attack in Operative systems and other software: bugs, instability and sometimes even bloat and vaporware.

Do you think that Open Source will play a part in the future of game development?

John Carmack: I have spent a lot of time thinking about that.

I was trying hard to get an article together about game code licensing to go out with the interview questions, but I just didn't make it in time. I had written three pages of article and four pages of other stuff that I had ripped out because it was going off on various tangents.

First, it is interesting to examine how coding is similar or dissimilar to art, music, design, etc. Most GPL works don't have to face the issue, because the work is clearly dominated by code. A few little icons aren't enough to make people really think about it. The argument is significant for games, because coding is only about a third or less of the work in most cases. The arguments that RMS puts forth for the ethical rightness of free software also seem to apply to all digital media. If you take them seriously, the spirit of the GPL seems to want to say that all digital media should be free. That isn't a pragmatic battle to try and fight.

If you just focus on the code, I think there is indeed a viable business model for a line of titles based on open source code with proprietary data. It will take either a very small company, or a very gutsy big company to take the first step. The payoff won't be until the second product.

I think open source is at its best with games (and probably most other things) in a post-alpha model. Fixing, improving, and building upon an existing core is obviously extremely fruitful in an open source model.

Going open-source from development day one with a game probably doesn't make much sense. Design by committee doesn't work particularly well, and for something with as much popular appeal as games, the signal to noise ratio would probably be very low.

I tagged along at the beginning of a from-scratch open source gaming project (OGRE), and it more or less went how I feared it would - lots of discussion, no code.

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While the mod communities may not be exactly OpenSource?, I think they work very well. There is some value in having focused areas to work in, rather than just having the entire thing dumped in your lap.

I am going to be releasing the majority of the code for Q3 soon, but there will still be proprietary bits that we reserve all rights to. We make a fairly good chunk of income from technology licensing, so it would take some damn good arguments to convince everyone that giving it all away would be a good idea.

Something that is often overlooked about Id is that Kevin and Adrian together own 60% of the company. They are artists, and most definitely do not "get" free software.

Chapter 9

John Carmack Interview

This interview was conducted by Bob "CalBear" Colayco for Firingsquad on Feb 09, 2000.

Interview

Prologue

John Carmack is a man who almost needs no introduction - a founder of id software, the company that invented the first person shooter and singlehandedly revolutionized what PC action gaming means. From Commander Keen to Doom to Quake, Carmack/id's games have captivated millions of bleary eyed gamers into spending hours on end at the computer, blasting away at their on screen opponents.

Late last December, Firingsquad and Gamers.com had the unique opportunity to conduct a lengthy face to face interview with John Carmack. We took the opportunity to find out more about John the man as opposed to John the programmer. We also asked John about his and id's plans for the future as well as his take on the gaming industry and where it might be

headed. Questions are in bold; John's responses are in plain text.

Questions

9.1   The Man Behind the Phenomenon

Bob "CalBear" Colayco: So how old are you?

John Carmack: 29

Bob "CalBear" Colayco: Do you think that being married will detract from your programming?

John Carmack: No, I wouldn't be getting married if I thought that.

Bob "CalBear" Colayco: So what's a typical date between you and Anna [Kang]?

John Carmack: Lately we've been building some model rockets. I did an interview one time and someone asked me about my teenage years, and I mentioned rockets and bombs and stuff like that. And I was thinking, you know, that was kind of fun, I liked that. Of course nowadays you can just go on the internet and say "I want one of these and one of these and one of these." They now have powerful rockets that we never had back when I was doing it - these high powered rockets with something like 2000 Newton/seconds of thrust!

Bob "CalBear" Colayco: Do you and Anna ever 1on1 deathmatch?

John Carmack: Just yesterday we were out at Apple, and Anna was playing one of the Apple guys - she was kicking his ass. I was in a meeting with some other people, so they were playing for a while, and she was just waling on him. But then when I finished that meeting, they snuck me into that guy's room and they sat me down and I came back to a narrow victory. I expected to hear her cursing from the other side of the building. She still thought it was the other guy magically acquiring skills at the end of the game!

Bob "CalBear" Colayco: I've read some earlier interviews where you said you were into bombs and stuff. You were a miscreant kid, right?

John Carmack: Yeah in a lot of ways I looked back and I was an arrogant little jerk when I was a teenager. I matured over the years and when I look back now, I don't think THAT highly of myself as a teenager. I mean, I was really smart, I was already programming computers in a lot of ways. But I was amoral at many times.

Bob "CalBear" Colayco: What would you say if you were giving advice to people who have kids like you in their school?

John Carmack: Well I already knew exactly what I wanted to be doing. I wanted to be programming, and I knew this even when I was around 12. I knew that that's what I wanted to be doing and I had these clear ideas of what I wanted to get. You can't just say the world owes me whatever I want to get. But there are times when some things are necessary to help a kid along. My parents never really understood that about me, so I never got the computers I wanted and needed. I held that against my mother for like a decade, but we're all past that now

It was frustrating because I clearly knew what I wanted to be doing but it wasn't available to me at the time. It was always: if you want to do computers you need to go to MIT then you go work at a corporation as an engineer and follow "the path." But I dropped out of college, and started my own company. My brother followed a more conventional path. He got a degree and became a stock broker and that's what my mother expected that you're supposed to do. And he's doing OK for himself, but there's nothing like a few Ferarris to rub your parents face in."

I can say that everything's fine with my mother at this point in my life. We can talk about these things, look back and she recognizes that she was kinda wrong, but what good does that do? She's not raising another child or anything.

9.2   Carmack on Money

Bob "CalBear" Colayco: You have a good deal of money now - how does that affect you?

John Carmack: I have sufficient money that I don't need to work anymore; I really don't have to. That's a nice freedom, the freedom from anyone having the ability to have any leverage over you, as long as you've got the money to take care of yourself and you aren't wrapped up in having more and more money. There are a lot of people even though they have a lot of money, they can still be manipulated by the carrot of having more money.

In my position I have basically everything I want. I've got enough money to take care of myself and family so nobody, not any company, can have a significant leverage on me.

Bob "CalBear" Colayco: So is there some area where you thought you could use your money to have leverage in other situations?

John Carmack: I try not to think about it that much. I try not to be too proactive in terms of trying to make other things happen. I like to work directly on the technical aspects of things and while there probably are some things I can do like leverage the money in other ways, I'm much more interested in trying to accomplish things directly.

That's one reason why I'm not a very good manager. I'm an engineer, so I want to fix things directly. I want to set the circumstances up such that they become fixed even though in many cases I recognize the larger projects that need to get done. But it's not something I'm uniquely suited for.

There's a specific area that I'm very good at and I happen to enjoy it a whole lot, so I don't feel a whole lot of desire to go out and exploit other aspects. I do have a pile of money sitting around to do things with, but I'm happy with how things are.

I feel bad for some companies out there. The founders, who are these incredible engineers, are now directors of their departments doing management rather than engineering. At the same time most of the people

they are managing are nowhere near as good as they were at doing the actual work."

That's what I hope never happens to me. I want to stay in the trenches working on the things all the time. There is some benefit to sitting back, reading and researching and getting some broader scope on it. But if you're divorced from the low level nuts and bolts of things, like how this actually applies to the real world, then you're just an academic. You get these huge disconnects between what an academic can do and what somebody in production can do.

In the last two projects, my time has been split. I'd have about 3 months of pure research. I'm in that phase right now, playing around with different stuff. And then after that it's about 16 months of work on the project. It would be nice to shift that more towards research, but I would never want to devote a majority of my time to research. The whole point of research in my mind is you figure out a new way to do something, but then you want to go actually do something with it, not just have the knowledge that it's possible to do something.

9.3 Focus and Inspiration

Bob "CalBear" Colayco: Your focus is astonishing. It seems that you're uniquely suited to this time and place.

John Carmack: Focus is extremely useful. As far as this specific time and place, I do think software is an almost uniquely wonderful medium. But if it wasn't here, I'd be some other type of engineer or some kind of scientist. I could have a fine time working in any kind of hard science

Software is so wonderful in a unique way. The people who set up for a physics experiment spend a year of preparation time, tooling around doing things. And then you spend another year analyzing it. With software you can have an epiphany and just sit down and hash it out. You can make it happen right there. It's the most malleable media to be working in for any kind of intellectual pursuit. I do feel fortunate that I'm around in a time when all this is going on.

I can remember again when I was a lot younger, and I didn't have the computer I wanted. I had this frustration. I felt like I was "missing it." I felt like I should be writing these games, like the early Apple II games. I was genuinely frustrated because I felt like I was missing the golden opportunity. Of course at the time I didn't know that I was going to come in on the "later" golden opportunity.

You read the book "Hackers" by Steven Levy?

Bob "CalBear" Colayco: Yeah it was a great book!

John Carmack: I read that as a teenager. At that third section I was like "Goddamnit, I should be here!" Then about 10 years later, I thought back about it: "you know, if there was a fourth section in that book, maybe I would be in there!" That's a nice thought.

It was just interesting to see that. I honestly thought I was missing my shot when I was a lot younger, like it was a golden age in the early development on PCs, and I was really frustrated that I wasn't there.

Bob "CalBear" Colayco: Do you think that it's the very act of programming and the very act of making your ideas into code that's inspiring for you? Or were there actual games that you can name that you were playing on the Apple II and PC early on that inspired you?

John Carmack: I can name off the games that I really liked at the time, but programming in the abstract sense is what I really enjoy. I enjoy lots of different areas of it

In the gaming industry, there are a lot of people that are specifically in it because they love games and they want to create things.

My love for programming is a more abstract thing. I'm taking a great deal of enjoyment writing device drivers for Linux. I could also be having a good time writing a database manager or something because there are always interesting problems. There are some things that are inherently more rewarding than others. Graphics and games are probably the most generally rewarding area of programming.

Bob "CalBear" Colayco: How so?

John Carmack: Because you get really nice feedback. When you write

a graphics algorithm, it draws a picture for you. While data can be rewarding in its own way, in general the human species is wired to respond much more strongly to visual things and things that have to be interpreted from symbols. So there's something fundamental there why it's a neat thing. But we do get to work on a whole lot of areas. I enjoy all aspects of it, but games have always been one place where there are challenging things and it has its own reward at the end, aside from the problem itself.

Early on I was really into the RPGs, like the Ultimas, the Wizardrys and all those things. Some of the very early games I wrote for the Apple II were basically Ultima ripoffs. I also loved all the straight arcade games, all the classic games.

9.4   Epiphanies

Bob "CalBear" Colayco: In some ways, don't you think Dungeons and Dragons is just a program that you put yourself into, with words and tables, etc? A structure to tell stories in, like the Quake engine?

John Carmack: It's a similar thing about being able to create things completely from scratch, a media where you don't have built-in limitations.

In fact, the original story of Quake was supposed to be an RPG, well not an RPG exactly, but a fantasy game. It completely diverged from that because of Quake's sordid development process. Since then we've been much more honest about our goals from the beginning on what we're doing. They've been very different games but I've been happy with the results. It's unlikely that we'd ever go and do a fantasy/role playing game type thing.

Bob "CalBear" Colayco: I've heard that you've cut back on your personal dungeon mastering

John Carmack: Up through Wolfenstein, the entire company played every weekend. It tailed off basically in Doom. We ran a couple of games last year just for fun. It takes so much time though. To do a good job you spend a day playing and a day preparing, but there's no way now that I

can sacrifice 20% of my hours for anything now.

Bob "CalBear" Colayco: You have a special focus, an inspiration - how you can improve an algorithm or something. How often do these epiphanies come to you?

John Carmack: Well, I think a lot of people put too much emphasis on the epiphanies. Epiphanies are there, you do get them where you see clearly into something and all that. But it really is true that most great works aren't a result of epiphanies, they're the result of lots of hard labor. That is a trap that a lot of people fall into where you think that the epiphany is the important thing. Sometimes it is, but in 95% of cases it's just a matter of smooth, calm integration of everything you know.

It's not the one brilliant decision, it's the 500 smart decisions that really make things good. It's more a matter of being able to keep making smart decisions. Making one brilliant decision and a whole bunch of mediocre ones isn't as good as making a whole bunch of generally smart decisions throughout the whole process. And there's so many of them that have to be made.

Even at the end of Quake 3, I had a to-do list of a thousand things that could potentially be improved on. So it's a matter of going through and knowing all these things that could be done, and prioritizing what the "sweet spots" are. Like "This amount of effort would get this batch of things done and it would have this side effect." Or "it would take all day to do this thing but it would probably destablize something else, so I'm not going to do it."

I definitely enjoy the epiphanies when they come - when I can be working on something and just realize that there's a much better way of doing it. That's very rewarding but I can't say that those happen every day. To a lesser degree, there's some insight where I can actually come home and tell Anna, "I figured something new out today!" That happens fairly often, and that's good.

9.5 On Open Source

Bob "CalBear" Colayco: Most people would say you're one of the world's foremost gaming engineers. Do you think that in this world that there's enough of a range of tasks and depth to keep you intrigued for years to come?

John Carmack: Sure, there are a lot of different things. Right now, I'm spending more of my time in this lull or break, working on some things in Linux. One of the things I've done is written two 3D drivers for Linux or done a good chunk of the coding on them. That's useful for me as a developer, because I certainly do the high level stuff, the API level programming, but it's also good to go ahead and take it underneath that. Doing some implementation level stuff on the device driver down to programming the hardware gives me more scope, looking at things through the entire process. There are a lot of programmers who only know things from the top and don't realize why things are sometimes the way they are because of the structure that's "invisible" to them.

One of the other things that I'm considering doing is (because I like knowing things very clearly from the highest to the lowest level) spending some time implementing my own network stack for the research and the learning experience. I've also got some experiments I want to try, finding out how much overhead the operating system actually imposes on the routing time and queuing things down to a serial driver level and a packet driver level. There's some information that I'd like to get from below the layers that you're normally communicating with.

Bob "CalBear" Colayco: Just in Linux or Windows and Mac also?

John Carmack: Well the thing is that it's just easier to do under Linux because you've got the ability to take anything you want out. While Linux is clearly not ready for replacing Windows on people's desktops, there is something fundamentally cool there.

The whole way I got into this is that someone had written a Linux driver for the Matrox cards. I had been reading about it for a while. Apparently they had it working barely with Quake 3. So I finally got around to downloading it and checking it out. I was pretty impressed by how well it

worked. It was slow but it was pretty nearly feature complete, good quality implementation. But there was this really obvious bug with the way textures were swapping. They were swapping most recently used instead of least recently so you'd see it thrash on the screen.

I knew exactly what it was doing so I said "OK, this has the source code available." So I figured out how to download it, get access to the CVS repository and all that, worked my way through the code, found the bug and fixed it! That's just fundamentally neat.

The corollary of that is that Apple had exactly that same bug in their driver for a while. So here we had a case of the same bug appearing in two drivers, but the Linux one I was able to just go in and fix it. While there are certainly a lot of barriers to entry on a lot of levels with that, it's nice to have that ability. Fundamentally if you know that if you're working on this system that's all open source, if anything annoys you enough, you can spend the time to go fix it yourself. You don't have to wait for anyone. You don't have to ask nicely for it, or wait for a patch.

It's not usually cost effective time wise to go do it. But if something's really pissing you off, you just go find the code and fix it and that's really cool.

9.6   More on Linux

Bob "CalBear" Colayco: So that's exactly your kind of attitude, hands on. You don't wait for anyone to issue an update, you'd rather do it yourself.

John Carmack: Right, so that's why if I was to be doing some networking research or whatever, it would be something where you could do it in Linux, where if you want to you can go and gut parts of the operating system and say "OK I'm just going to grossly cut all of this out right now because I want to be doing something experimental." There's a lot of freedom there.

And I do think over the course of the next couple of years, the usability stuff will be straightened out. There are a lot of economic trends that make it relevant. You start looking at PCs costing under $500 and there's a $90 Windows license in there. If people are just using it for the basic

stuff, I think there will probably be a fairly significant demand for a free operating system.

There are a lot of zealots in the Linux space that just don't have rationality in their viewpoints, but there is some truth behind the hype on how good it [Linux] actually is.

Bob "CalBear" Colayco: So you're very focused and you drive yourself. But have you thought about taking on a boss to help you learn new skills?

John Carmack: I can see there is some benefit to having management on some things. We brought Graeme on at the end of Q3 to help manage some aspects. It didn't wind up having any real impact on the way I was doing things, because Graeme's not fiercely organized enough to stay on top of every little thing. It turns out that my personal organization is greater than what most managers would wind up imposing on me.

I am aware of the limits of my personal organization skills. I have that list of a thousand things, and every once in a while I start bubble sorting things up to the top. I do think that it would be great if somebody were here whose primary job was to make sure they knew and understood all of those because everyone has their own weaknesses in organizational skill. You don't recognize yourself doing it but there are some things that you don't want to deal with that end up bubbling down. I recognize the benefit of having somebody who's kind of a conscience for you on the workload.

Recently I put out a call for someone to be doing some conformance testing on the OpenGL aspects of things, specifically the Linux driver stuff. I'm doing a reasonable amount of coding on that, and I'm trying to be reasonably conscientious about it, but I know that I'm directing things in certain ways to meet my goals. I have the ideal desire to do the perfect implementation, but I recognize that in my limited time I wind up directing myself not necessarily in the best coverage.

So sometimes it is good to have someone who can sit back and be a conscience for your effort. But it's all still a theoretical issue to me. I believe that there can be benefit but I've yet to see it demonstrated.

CHAPTER 9. JOHN CARMACK INTERVIEW

9.7 Carmack the Student

Bob "CalBear" Colayco: Less about organization then, what about a boss as a teacher? Is there anyone from whom you feel you could learn from?

John Carmack: I actually learn things from almost anyone. This is one of the major differences between me as a teenager and me now. My views as a teenager were that "I am smarter than all these people around me, and therefore I will completely ignore anything that anyone has to say." I went through a couple semesters of college classes like that. I look back on it now and realize that I was not treating things in the right way. Yeah, maybe I was smarter than the professor but it didn't mean that there weren't things I could learn from him.

The way I go about things now is that everyone I work with in the programming level I learn something from. I can look at the time I spent with Brian Hook. I learned some better C coding standards and stricter use of struct and const that I wouldn't normally do. That's been a positive thing that I've improved on because of him. And then there's Graeme - I'm seeing him put some things together very quickly from the Java libraries - things that I would have rolled from scratch and taken longer to do.

So it doesn't take someone that's necessarily a "better" developer or programmer for them to have things that you can learn from; that's a really important lesson that I've learned over the last decade. There's knowledge waiting to be gained all around you in just about everything. There's benefit to putting yourself in an information rich environment like a university IF you've got the right attitude. If you're looking for anything to be learned from anywhere you can get it, rather than looking for the one "motherlode" of useful information where you've got everything together. You have to glean things. You have to be able to grab things from anywhere you can get it.

During the development of Quake when we hired Michael Abrash, I was really psyched about that because I learned a lot of my early PC programming skills - assembly language and graphics - from his articles in Dr. Dobbs. So that was really great to bring him on. I did pick up some further things from him but it was interesting.. it was almost uncomfortable

for a while because he got fairly deferential on the programming side to me about things. Michael knew an immense amount of stuff, but I've still been on this very quick learning curve.

So almost all the programmers I've worked with, I've learned something from.

Bob "CalBear" Colayco: OK you mentioned gleaning things from the world around you. How about non-technical sources - recent books and movies.

John Carmack: My favorite book in recent years has been A Deepness in the Sky by Vernor Vinge. As far as movies go, I'm not sure what I'd say is really inspiring. I see most of the reasonably good movies that come out. Toy Story 2 was wonderful - I really enjoyed that.

Bob "CalBear" Colayco: The Matrix?

John Carmack: Matrix was wonderful. All the great sci-fi, action movies and everything. I'm not too big into deep meaning movies, I go to movies for entertainment and a lot of that basically plays out in our games also. We are kinda the Arnold Schwarzenegger movie of computer games.

9.8   Quake and Simplicity

Bob "CalBear" Colayco: Why do you think people like Quake 3?

John Carmack: Specifically what we set out to do with Quake 3 was just a completely eyes-wide-open-focus on the game just being fun while you're playing it. There's no sense of hubris about the grand design or anything about it, or trying to impose a story or a tale on top of all this. It's looking at a game in it's fundamental sense of what you're doing has to be fun. It's not a matter of beating the game into submission or accomplishing something, the actions have to be fun.

There has to be something that you wanna just go out and do. People don't play softball because they want to beat the game of softball; it has to be an action that's fun by itself. I think that we succeeded in a lot of ways

there. We expected and did receive a lot of feedback from the incestuous core of our fanbase.

There certainly are people who want more and more complexity and sophistication in things. That is a viable direction to go for games, but it does lead towards a stagnant core. You get like what you have in the flight simulators, where you have games that require you to read this giant manual before you can get in and have fun. There have been flight simulators where you just jump in, fly around and shoot things, and those are fun and interesting. Then there are these serious simulators where you have to convince yourself that you're being entertained.

It's possible to do a first person shooter like that, where it requires so much knowledge about what's going on, how things are supposed to work, strategies of all of these things, that it's just not fun to sit down and play. And there would be probably a couple of hundred thousand people that would like that, but I wouldn't actually be one of them. I don't have the time to sit down and learn it. I never got into any of the complex mods that would require like a whole bunch of complex stuff to learn. I still like playing a simple, fast game, where you jump in and have a good time, and I think there are five times as many people in the game buying world that also feel that way. But those 200,000 people that want the extremely sophisticated, complex games, they've got my email address and they make themselves known. We set out expecting that.

Bob "CalBear" Colayco: So what was the last non-id game that you spent more than 2 hours playing?

John Carmack: Probably F-Zero X on the Nintendo 64 - racing cars.

Bob "CalBear" Colayco: have you ever thought of making a driving game?

John Carmack: We talked about it right after Wolfenstein. I was working with some voxel-landfield technology and we did a really brief demo of a little car driving thing. But we've never taken anything close enough to proof of concept. But if we did do a driving game, it would almost certainly be in the fun genre, like the F-Zero games, rather than the really serious driving simulations. And again, there are many valid paths to games, but I have my personal biases, and they happen to be broadly held enough that we can do successful games and still be doing games

that I consider entertaining for me.

9.9 The Next id Game

Bob "CalBear" Colayco: So you would describe your personal biases as not necessarily so much driving but more about rocket launchers?

John Carmack: The games are for fun. And simulation games have never been that big for me, as far as flight simulators, driving simulators and all of that. I recognize in some aspects the element of entertaining there, and it's certainly not like I'm saying "these are no fun, nobody can enjoy these," but it's just they haven't been my personal favorites.

Early on I loved the RPG games, but as my life got busier and busier with other stuff, I didn't have that much time to spend on those. I've always loved the simple straightforward arcade games. And while they've changed a lot in going from Gauntlet to Quake 3, they're still the same kind of fundamental things - you run around, you fight your enemies, you pick up stuff, you make it to the next level in time. It's a fundamentally valid, core, primal gameplay element there, and I don't feel bad about even making relatively similar games like Quake, Quake 2, Quake 3 on the different styles of things. Just like there have always been driving games and flying games, there's always going to be action first person shooters now, and I think we've made good steps in each of our projects. We probably are going to be going a different way with our next game, because not everyone at the company does feel the same way I do about that. So we're likely going to be doing something a bit different next time, but we haven't exactly settled on it yet.

Bob "CalBear" Colayco: Have you decided if it's going to still be a first-person game?

John Carmack: It's very likely to still be a first person game, but it may not be an action game. Graeme and I have been sitting around talking about game design ideas for different things, and they cover a pretty fair range, exploring a few different choices that we've got, but we're not prepared to talk about any of them yet. They are likely to be first person, almost

certainly.

Bob "CalBear" Colayco: I just thought it would be interesting if id went into RTS or something else, the same way that Blizzard went from RTS into creating the action RPG.

John Carmack: I'm not a real good real time strategy player. Actually, I've never really sat down and played much of one. Just not my type of thing. It's just a whole difference of - the first person games are the most immersive kind.

Real time strategy games are among the least immersive, you're directing your forces, and it's clearly not you in the game. I think it's very likely that we'll be doing something that's still first person. It's a small step to third person, but I actually think there's probably other companies that are better suited to do third person, companies that have more directorial ambitions.

Unlike many people in the games industry, I have absolutely zero desire to be making movies that go on the computer. And that's the downfall of a lot of companies. A lot of game designers wish they were directors, but I think you should make up your mind. And I'm clearly in the game designer part, rather than the director part. That's also the draw that puts a lot of people towards third person games. Third person is definitely better for showing off things like character animation. Steed would definitely love to go to something that was much more animation focused, but it's probably not going to be the next step. That's not completely out of the question, but I would bet on staying with something first person.

9.10   On the Gaming Industry

Bob "CalBear" Colayco: So it's interesting that you say movies on your computer are the "downfall of some companies," because a lot of the 3D card companies like 3dfx and Nvidia actually use that as their mantra - putting Hollywood on the desktop.

John Carmack: There are interesting aspects to that - one thing is that the amount of labor required to do the highest quality utilization of today's

3D engines is very quickly approaching what you need in Hollywood set design. Like right now, Quake 3 wasn't really even close to pushing the limits of what we could do if we were aiming for lush visuals, because we had to maintain this fast speed throughout the whole thing.

But if somebody took basically this year's level of technology, this Christmas's products and said "I want to do the most visually stunning thing that's going to be the closest to the movies," it's possible to do that right now beyond the level that people have really seen. The technology's there. And that's where it's been going for the past year or so on there, specifically some things like full texturing of the levels where set designers have to go in and airbrush their sets in the different ways and build all these things up with models. That level of effort can now be spent in computer games. It didn't used to be that way.

In the days of Doom and Quake, you didn't have the ability to put that much labor into it. If you've got a room and a hallway and another room, it's like: hallway, block block ceiling. And that's it, that's all the possibility you have to do, so there are limits to how much work can be done there.

Bob "CalBear" Colayco: So you're always going to be in favor of creating games with smaller teams of people; so that keeps the door open for the kid in his garage with his friends down the street...

John Carmack: It's not like we've tapped out all possible game genres. A lot of people do complain about the industry in various ways, and there is some real truth to the fact that the publishers don't want to publish a new idea. Chris Hecker from Definition 6, he's one of the guys pushing physics in a lot of ways; he does a lot of the geniusy stuff. He's had this little game demo that he's been working on that's a novel idea. And it's using physics as the core principle, but it's not like "let's take physics into a first person shooter," it's a completely different game. It's actually a good game design to tie in with the physics. But the publishers just aren't interested in that.

And that's too bad, but on the other hand, there are some positive signs from some other things, like the guys who do simple little games, and sell them over the internet and make a lot of money, like a couple hundred thousand dollars a year on downloaded stuff. I'm heartened by that, because it is neat to see that there are some people that can make good

money doing games that are outside the mainstream; that's possible because of the internet.

We were successful in shareware early on. With the original Keen trilogy, we were making $100, 150 thousand a year on that. With the second trilogy, we were up to making half a million a year from shareware. And that was before we had any commercial boxes. And it looks like it's possible to do even better than that nowadays. So that's kinda cool. But the mainstream boxes on the shelves, buying your endcaps and shelf space, there's not a lot of desire from the publishers to do interesting new things. I'm sure there are new genres that are ready to pop up, but there's some resistance to that.

9.11   id is not a publisher

Bob "CalBear" Colayco: Are you interested in Halo at all?

John Carmack: I've watched the movies of it; it looks pretty good. The one problem right now is that there's no way to really judge anything from screenshots because any halfway competent rendering engine can render any given scene. And it's only in how things tie together that there's any differentiation. Certainly the Bungie people, they've got a lot of talent. And they've been doing this basically as long as we have. They were kind of id's Mac shadow for many years. But now that they've gone ahead and had some mainstream PC success, they're doing pretty well.

Bob "CalBear" Colayco: Going back to creating new genres, and the resistance from the publishers, is that something you'd be interested in promoting, to help get new genres out there, maybe supplying money to publish these games?

John Carmack: I'm positively not interested in being a publisher. That was a multi-year argument at id. If you think back 5 years ago, all the game developers wanted to break in to become publishers because there were lots of the little teams. This was before everything consolidated down to the few major ones. We argued over that for a long time, and we self-published the original Quake shareware stuff, and when all was

said and done, we probably lost money on it because of colossally bad business management in different aspects of that. But finally everyone agreed, especially as we see the publishers consolidating, coming down, that it is much better to be a developer than a publisher. Because being a software developer is this clean part of the industry, you hand off your CD and you get your checks in the mail. While, being a publisher, it just takes you into all these messy parts of the business that you really don't want to be, like getting people to pay you after they've taken and sold your product. I don't want any part of that side of the business.

Bob "CalBear" Colayco: What about using your influence to say to some publisher, hey you know, maybe you should give this a chance?

John Carmack: I don't push a lot. I can toss an offhanded comment about something like that, but I try not to undertake things that I know that I won't have the time and energy to push hard for. In fact that's very key to a lot of my focus. I'm willing to just ignore a whole lot of things. And that's pretty important, because so many things come in that are potential demands on my time, and it's just easy to see how people that are in a similar situation, wind up just getting their entire days spoken for, and not being able to do any work because every day, there's phone calls and emails from people that want to do something, they want to have an interview, or pitch a business proposal.

Sometimes I wind up feeling guilty that I'm not doing more. Especially this coming year, there are going to be a lot of divergent hardware designs, and there's not a clear direction where everybody thinks things should be going. I'm telling myself that I should be out there, evangelizing things, and trying to bring a consensus, because I am in a fairly good position to do that type of stuff. Microsoft listens to me on a lot of stuff. And certainly all the hardware companies do, and there's a good general level of respect and all that. But during the development of Quake 3, the time just wasn't there; I couldn't go do it.

And now I'm running around, trying to go hit a bunch of things, but I know that even now I'm not going to be able to really follow through, because it would practically be a full time job to just try and do that, to try and shepherd some of the things in the industry in a direction that I want it to go. I don't have the hubris to think that the world's going to hell

if I don't help it. So I can look at that and say, I'll do my best to help in a little way, but I'm not going to be able to give it the full attention.

9.12   The Trinity Thing

Bob "CalBear" Colayco: Switching gears a bit, I was reading some stuff about how now that Quake 3 has been put to bed, that you're going to spend a little more time doing more research on engines.

John Carmack: I've got a couple of engine things that I'm working on, as far as research.

Bob "CalBear" Colayco: So is one of those things Trinity? I think there's been a little confusion about "Trinity."

John Carmack: I was never really certain how this got as confusing as it did to everybody. After Quake, when I was starting on new rendering technologies and everything, everybody was just calling it "the next engine" or whatever. Michael Abrash suggested we just take Intel's tack of naming your next project after a river near you. We have the Trinity River in Dallas, and so it was just like "Trinity Engine," the next step. And of course we wound up not rolling that into a project because Quake II was derivative of Quake I, and I wound up stopping [Trinity] to work on Quake II, so there was never a specific project that was on. It was just like when we were talking about the work that I was doing, and at the start of Quake III, I went and did like six different research engines, for different rendering techniques and everything.

But it's still just the research work that I'm doing. It was like two voxel things, a spacewarping thing, a lumigraph thing, and then some of the stuff that actually turned into the Quake III engine, and some other stuff like that.

That's one thing that's been one of the real strengths of id and my technical direction in particular. You see companies that are wed to a clever idea; there are some specific games that you can probably name where they have their idea and that's what everything's wrapped around. I'm not tied to any of the particular ideas. Like I said, at the start of Quake

III I had like six different things to go on, and I looked at all of them and said, "these are more intellectually neat," but what we're doing for Quake III actually turned out to be kind of a righter path in many ways. And I've got a couple of things that I'm going on right now. But there's no one that's like got some magic tag on it, they're just all the different things that I'm going to be examining.

9.13 Voxels and Curves

Bob "CalBear" Colayco: You mentioned voxels and you're doing some research on that, do you think 3D hardware companies should be working on voxel acceleration? And what do you think of the voxel games that have come out, like Delta Force?

John Carmack: The Voxel stuff in software.. I've written a few voxel engines at one point, actually the early version of Shadowcaster, Raven's Origin title, actually had voxel floors in it at one time. But we wound up taking that out when we rewrote the stuff to be more polygon based. There are some real advantages to voxel representations of things, because it gives you complete texturing and detail geometry in many ways. But I did these two voxel engines at the beginning of Quake III and it got to the point where I thought that I could almost make them run in software, but it would be at a fairly low resolution and compared to what you could do, at that speed with hardware polygons, it doesn't pay off in that case.

I did do an analysis of what the memory access patterns would be and everything; you could do a voxel ray-tracer in hardware with drastically less hardware than what we're actually using right now for all the triangle rasterizers and I think it could be a much more compelling visual representation in a lot of cases. But it's gonna be really difficult to see, I almost hesitate to tell people to pursue something like that. I know that I did some walkaround demos and everything, but the reason the PC industry is as good as it is right now in hardware is because we all had the example of SGI to look up to. We had working existence proofs of "this clearly works, look they've done it" and then it's just a matter of matching and

then exceeding their performance.

To recommend something completely different, like saying "You should go have your fab make you a voxel chip, you should just go try this, spend millions of dollars on this," I'm really hesitant to do that because we don't have a complete existence proof that says this is a necessary and sufficient rendering primitive to do a complete engine or something with. Now if somebody did do a voxel caster there, you could go ahead and get depth value and intermix it with current triangle stuff and that would be an interesting intermediate step, but I honestly don't think it would take that much hardware, and someone right now, in this time of chaos when everyone's crazily trying to diversify their product, maybe someone will try something like that, just on a lark, because they're just fumbling around for something to do.

I think there are some potential good things there, but I can't conclusively say this is the future direction, because while it works really well for environments, and there's some great stuff you can do with that, it's less clear how well it works for characters. You wind up saying, "well maybe you have to build them in a deformation matrix around them, and then when you raycast into it bend the rays as it hits the deformation lattice." But I haven't written a software version of that. I'd be hesitant to tell someone that this is clearly a good idea until I can present a simulation showing that it works, and that it looks more impressive than anything you can do directly. And that's not on my schedule right now to spend the time to do because I've got a couple of things that are immediately pressing in terms of research.

But I do think there is at least some significant potential for that being an interesting direction. Now the thing that I actually want to play down on everyone is higher-order surface rendering, like curves and Nurbs and subdivision surfaces and all of this stuff, which everyone's all crazy about now. After working with them for two years, they're not all they're cracked up to be; there are all these issues. You don't see them from the outside, and this is the thing about being in the trenches as a developer.

If you just read the research papers and you understand how Bezier patches and all this stuff works, and you think, wow, this is neat, this is just the next step up from triangle primitives. And you don't recognize all of these

"in practice" problems, like with invalid normal but degenerate edges. How you can't do an arbitrary cut of a patch without raising it to like the square of the order of the side, you can't stitch two junctions by fixing the other things, there's all of these little things that actually wind up being a fairly significant pain in the ass in different cases that you're just not aware of from this bird's-eye view of it. And there may very well be all those issues with voxels too, which is again why I'm hesitant to just get up on a pulpit and say this is the future, because a lot of things look great from the outside and aren't necessarily so great when you get down to it.

9.14 Looking at the Competition

Bob "CalBear" Colayco: So since you're going back to your research, is this going to have an effect on when the next id game is going to come out?

John Carmack: It depends on what we wind up choosing for the next step. Both of the technologies that I'm working on are stuff that can fit fairly well into the existing Quake 3 framework, so there is a possibility that new technologies will wind up going into the next product. Currently we have this wonderful opportunity where we've got this rock solid, stable, expandable, flexible engine where we could do a game design and not touch much of the engine... and that would be really nice from a management standpoint. However, if we do that the stuff that I'm doing today probably wouldn't see store shelves for like three, four years or something, and that's just a long time for something to go. So there's going to be a really strong incentive to push some of the technology into the next product.

Bob "CalBear" Colayco: Do you do much research by playing other games, looking at competitors' products?

John Carmack: I played Unreal most of the way through, I'll probably play Unreal Tournament most of the way through, although I haven't yet, aside from some of the demo stuff. I don't do a really thorough canvassing, play everything that's out there. Usually I watch over someone's shoulder when they're playing the hot new game. But I don't spend that

much time actually playing other games. I certainly play more Quake 3 than any other games out there.

Bob "CalBear" Colayco: Is there someone in the company that does do that?

John Carmack: Christian and Graeme play most of the new games. It used to be Brandon who played every game, when he was at id, everything funneled through there. Tim does it more for some kinds of like research purposes; Tim's fairly conscientious about looking through the other stuff, but Graeme and Christian probably play the other games more for fun.

9.15   Carmack's Research

Bob "CalBear" Colayco: Can you give us an overview on what you are researching now?

John Carmack: One of the rendering engine things that I'm working on specifically is a better lighting model. Quake 2 added radiosity lighting to the calculations where you would get realistic bouncing of light on there, but a lot of people actually didn't like that because it took away from some of the harder shadows where it kind of murked out more things, even if it was in a more realistic way - a lot of people liked the stronger shadows. In Quake 3 we went back to just a direct cast light, at least partially because I didn't want to do the finite element radiosity on the curve patches. The other thing is allowing us to manually make things look better by giving the artist the ability to texture and cut geometry everywhere. So those are the two directions and in fact, they can be combined or used together. They both have interesting technical challenges associated with them. Those are things which may very well show up into our next project.

There's some other research stuff I'm working on which isn't game engine related. I'm working on some vision research with webcams, like some head tracking stuff. There might be some kind of gimmick things I can integrate into games with that. Like when you're bobbing and shaking

your head, your character can do that. Or maybe like the holographic window scenes where you move your head and it actually changes the view for you. I don't think the webcams have a fast enough latency to do that without some lag, but that's still some interesting stuff. There are other levels you can take this to, with facial expressions, etc.

I think there are probably more applications for all this than I can think of. All the little interesting discontinuities happened with changes in input/output devices. Things changed when people started using the mouse for everything. I think "computer vision" is practical enough that it may very well have a "mouse-like" effect on things. After all, there were things that you could do with the mouse that you wouldn't do with the keyboard. That's still in the random guess phase of things.

There are interesting things now that we have enough CPU power to do some pretty good stuff. And it also, unlike a lot of the graphics stuff, has a lot of unsolved research problems. There's active research going on but we don't have "that SGI example" to know how to put things together and just worry about making it fast.

The last direction I'm interested in is getting some more generalization of 3D technology, moving towards being able to do things with other rendering stuff like HTML inside 3D worlds, and being able to build little cyber space things that are not specifically game related. I believe there's an infrastructure framework that we can build. We can build a first person shooter, but the framework is general enough that we can do other things with it.

All the existing software is built clearly as a first person shooter game, but then people do other interesting things with the technology. It always costs a bit to generalize. You can always make something more efficient by specializing, but at some point you reach a decision where the cost to generalize is not that painful and the benefits by having a more general platform can be pretty significant. I think we're at that point for 3D games right now.

We clearly weren't two years ago. We were still caring about every last little frame to squeeze out any bit of performance. This isn't the case anymore with the trends in hardware acceleration, especially with geometry acceleration, much faster CPUs, more RAM, etc. I think we can do things

that are 90% or more as fast as the specialized version, and still have the possibility to do a ton of other interesting things with it.

9.16   Miscellaneous Bits

Bob "CalBear" Colayco: So you might be thinking of a persistent Quake world where people are having conversations and such.

John Carmack: Yeah, not even necessarily Quake related. I think there are some interesting things to be done in communication with the medium. You see people follow each other around, meet on a server, etc. There's a lot of potential directions there. I wouldn't tag it with virtual reality because VR is a term laced with death and destruction. There's never been a successful VR company, but I think a lot of that was really because the time wasn't right technically. In a lot of cases, creativity and innovation are constrained by technical curves.

Specifically this comes up a lot with Doom. It took a lot of cleverness, creativity, and smarts to do Doom but all that cleverness, creativity, and smarts five years previously wouldn't have mattered because it just wasn't possible at the time. There are times that are appropriate for new innovations to happen.

I think that the next couple of years will be one of those times for some of those innovations to happen, like the generalizing of 3D interfaces. Everyone goes on and says that at some point the internet and the web will have a 3D interface, in this vague, airy sense. But the concrete details never come out on what actually needs to be done. It may be time for something like that and it may not.

I'm looking at these different directions on things and I'm going to pursue all of them, and I'm going to wind up following through on the ones that are most promising.

Bob "CalBear" Colayco: Is Jan Paul (Mr. Elusive) going to continue on with the company?

John Carmack: He is dead set on finishing up his college studies. He

won't commit to it yet, but we're probably going to have him back. We're certainly going to be working with him on various things, but we have officially offered him a job if he wants it.

Bob "CalBear" Colayco: Do you recommend that people go to school or not?

John Carmack: If you go into it for the right reasons, it can be a good place. University can be a very information rich environment. I do look back and realize that I wasted some of the time I had there. I could have been going in and using their graphics workstations and other facilities that I didn't take advantage of.

If it's just a matter of going in to get a degree so you can get a job, then I'm not wild about that. If you're going there to meet smart people, expand horizons, and learn some things, then I'm all for that. Some people learn so much better like that. Me, I've always been the type that reads a manual or something like that. I just prefer to learn that way, but not everyone's like that. I don't think college is a bad thing, but I would not hold to some truth that "you must go to college, it's the only way to succeed" because clearly it's not.

I do think that at least for young and fast moving industries like the internet and game design, talent and a resume that shows you've done some things means more than a degree. I've never asked someone "do you have a degree?" It's more a matter of "what have you done?" If it's a choice between sitting in a lecture hall and taking a test or staying at home to write a game mod to prove you have some talent, then I think that can be a reasonable way to go.

Bob "CalBear" Colayco: One last quickie - what consoles do you have access to right now?

John Carmack: The only one I have hooked up at home now is the Nintendo 64, but wrapped up in cords, we have Playstation and Saturn and others.

CHAPTER 9. JOHN CARMACK INTERVIEW

Chapter 10

John Carmack Interview

This interview was conducted by John "JCal" Callaham for Stomped on Aug 04, 2000.

Interview

Prologue

John Carmack was here at QuakeCon earlier today doing an TV interview for Gamespot TV and generally wandering the QuakeCon grounds. However, Carmack was nice enough to take some time to do an interview for Stomped.

Questions

John "JCal" Callaham: What do you think of the convention so far? Is it gratifying to see all these people here to basically celebrate a game that you helped to create?

John Carmack: Well, the whole history of QuakeCon has been wonderful. I mean, just from the very first get-together about lots of people with poor planning crowding into a hotel and everything to the pretty well put together, well run convention in the past couple of years. It's impressive to see them growing continuously in size and to have more and more people attending and more vendors. Tim (Willits) came in and said "It's like a mini-E3 this year."

John "JCal" Callaham: The first Quake 3 engine based games are now beginning to appear. Star Trek Voyager: Elite Force and F.A.K.K. 2 are already out in some form and others are coming out. What do you think about the quality of the games that are using your engine?

John Carmack: Well, Star Trek has been nice in that they (Raven Software) actually got a reprieve on their deadline push. They were able to go in and put in that extra set of polish that game developers always wish they had, while F.A.K.K. was kind of in the opposite sense were they (Ritual Entertainment) were really kind of like right up to the wire to fix the last things before they get it out, which I hope works out OK for them. People seem to be really enjoying playing F.A.K.K. and it look gorgeous; they have wonderful stuff. There is definitely the danger, though, that they have maybe been a little bit to close to the wire and we will see how that plays out.

John "JCal" Callaham: You must also be gratified by the interest that Sega has in Quake 3 Arena. What do you think of their port of your game to the Dreamcast?

John Carmack: Well, actually Sega didn't do it. It was done by Raster Entertainment. It look spectacular, doesn't it? I mean, when you look at it across from there it looks like the PC version in many cases. In fact, for a lot of people it will end up looking better than the PC version because we used compressed textures on the Dreamcast where the average person

starting up Quake 3 get the slightly blurred textures on there unless they got a 32 meg card and they crank everything up, while on the Dreamcast you get most of that detail just kind of out of the box. Of course, a lot of types of games just tend to look better on a TV set with the kind of blurred together very cheap anti-alising.

John "JCal" Callaham: Sega is also playing up the fact that you can play the Quake 3 port with Dreamcast players and PC players on the Internet. Do you think that's an important feature to have to bring more of a mainstream player over to Quake 3 in this regard?

John Carmack: Well, I actually think it will be important to keep them fairly separated. We are probably going to have two masters where one is Dreamcast-only and one is kind of open, because there is going to be such a huge delta between the people who are going in playing with the joypad versus the people going in playing with the mouse and keyboard. I just think that would not be a whole lot of fun to be playing with your joypad unless you got really, really good and want to go out to the open tournament area.

John "JCal" Callaham: I know you can't talk about your current project, but how are things at id right now?

John Carmack: Well we got lots of really interesting technology coming out. We have got the strongest programming team we have ever had in the company where we've got programmers that are working on areas that we have conventionally short-shrifted. Some of the things like sound and game logic are things where I would just always do something that's acceptable that would get the job done. There was never like a primary focus for it. Now we've got expert programmers dedicated to it. We've got a programmer dedicated to making great sound; a programmer dedicated to making great game technology; a programmer dedicated to great tools. Of course, we are going to have great graphics and great networking and all this type of stuff we have always been known for, but a lot of the areas that have been kind of our secondary strength are going to be brought to primary level and that's going to be really cool.

Chapter 11

Knee Deep in John Carmack

This interview was conducted by Billy "Wicked" Wilson for Voodoo Extreme on Sep 18, 2000.

Interview

Prologue

John Carmack, Co-founder of id Software and Lead Programmer; creator of engines. From the early days of DOOM id has been on the bleeding edge of the first-person-shooter scene, revolutionizing the 3D action genre. Today, we have part three of our lengthy interview series with John, featuring questions submitted by many top industry professionals, including Valve Software's (Half-Life) Gabe Newell, 3D Realms' (Duke Nukem) Programmer Brandon "GreenMarine" Reinhart, Epic Games (Unreal, Unreal Tournament) Designer Cliff Bleszinski, Human Head Studios' (RUNE) Chris Rhinehart and of course your pals – the Voodoo Extreme chumps (Billy [most of the questions], Apache [editing and HTML],

Eidolon [he's just a chump]). Topics include: DOOM III, id Software, games in general, technology, programming and much more. Enjoy the third part of our series, we hope you enjoyed reading it and can't wait for more DOOM III goodness.

Questions

Billy "Wicked" Wilson: During the development of Quake III Arena, you released Q3Test. Are you planning on doing something similiar with DOOM 3? If so, when would you plan on doing it (rather, how far along in the development process, not a specific date or time frame)?

John Carmack: There will certainly be a test. I am a firm believer in the benefits to the final product of doing that.

Q3Test was released too far ahead of the commercial product. The game engine was nearly ready to ship, but the bot code was still completely unresolved, and wound up causing the real ship date to be much later than expected. We will probably try to have a test for the next product much closer to full beta time.

Don't hold your breath.

CliffyB; Epic Games: The climate for a successful FPS has changed dramatically since Doom first hit the market. As great as Doom was, any game that comes out now and features 40 hours of mindless shooting with key/door/switch puzzles will be ravaged in the press and sales will suffer. Half Life didn't just raise the bar for SP FPS gaming, it destroyed it, and with the possible exception of System Shock 2 and Deus Ex no game has come close to capturing the public's heart...and gaming dollar.

John Carmack: You won't get any argument from me about the significance of Half Life.

Billy "Wicked" Wilson: We rarely see any major sound advances in games these days, seems most developers focus on the visuals. Are you planning on doing anything different with the sound engine in Doom3? I ask this as, as we've seen in some recent games like System Shock 2, in creating a

genuinely creepy game, sound can be an incredible thing.

John Carmack: Graeme's primary task is going to be a completely new sound engine. Coupled with the fact that this will be the first project where I am comfortable using threads (previously the cross-platform issues have nixed it for me) for required background streaming, we should have quite literally an order of magnitude more audio richness than in our previous games.

Billy "Wicked" Wilson: Has id ever thought of doing JUST engines/technology, rather than developing games, or would you get bored with this?

John Carmack: It wouldn't work.

It would be a pretty fair analogy to say that writing a game engine and selling it to someone without having actually built a game with it would be like writing a program and selling it to someone without trying to compile it. Even if you know what you are doing, you are going to miss important things.

Even now, as we test the DOOM renderer, the level designers constantly present me with pathological uses of resources that I would never consider doing, but they did the first day. Programmers tend to avoid doing things that are going to hurt their code. Level designers don't know any better.

Billy "Wicked" Wilson: Support for bump mapping? If there is, can you expand on that? Is it artist produced bumpmaps, or procedural?

John Carmack: Oh, yes.

Billy "Wicked" Wilson: What's your favorite Arcade / console game?

John Carmack: Hmmm. If I had to pick a number one for each, it would probably be the arcade Super Mario Brothers and the original Sonic the Hedgehog.on genesis. I took a job at a pizza parlor when I was fifteen in part because they had a SMB machine.

I loved most of the classic arcade games. The direct-acting feel of the controls on the old games is almost lost in arcades today, with all of the vaguely-working gun games and the fighting games with their time dependent blind control sequences.

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Billy "Wicked" Wilson: Any personal interest in doing a game outside of the FPS realm - I'm thinking of the comments you made on doing a Commander Keen game on the GameBoy.

John Carmack: I get the urge to do programming-in-the-small at least once a year, but I don't think I could devote myself to doing a good job on another platform without abandoning more pressing work on the PC platform.

The pace of Moore's law with regards to the history of gaming makes for some interesting thinking. Our data sets and processing are such that every arcade game I ever played as a teenager could be included, and run simultaneously, with the resources that we currently use for a single level. While intellectually I know that throwing an extra dozen rendering passes on all our surfaces now is The Right Thing for our market, part of me would still like to take 64k and really make it count again.

My interest in rocketry over the last year has given me some vague notions of a hard sci-fi game of strategy or role-playing in the solar system a couple hundred years from now, but I doubt I will pursue it.

I do think the time is right to have FPS infrastructure transcend its market niche and become the general infrastructure that VRML and others always envisioned. That was one of my major pitches post-Q3, but it wasn't received with much enthusiasm - most of the people here are game guys, not infrastructure guys.

I have also proposed two other games that were still first person action games, but with different enough play styles to stand apart from our previous work. In the far distant future, when DOOM finally ships, we will certainly go through the whole debate again.

Gabe Newell; Valve Software: With Gameboy Advanced just around the corner, still not really a 3D capable device, what would John like to see in the way of a handheld gaming platform?

John Carmack: I can't believe there is going to be another gaming device that still has the concept of "tiles". I am really quite shocked. The Atari lynx showed how it should be done YEARS ago: a memory mapped framebuffer, a reasonable CPU, a blitter coprocessor, and unified mem-

ory (large form factor and short battery life were it's problems). Several more backwards handheld systems have unfortunately been produced since then.

A device that was basically half or a quarter the speed and memory of the U64, but with a similar architecture, would have made a great handheld. However, I wouldn't be surprised if the hardware optimum involved having 256k or so of embedded video memory on the LCD/graphics controller. It wouldn't be as convenient to program, but it would let it get away with a much lower performance memory subsystem.

Gabe Newell; Valve Software: Ken Perlin has been working with Microsoft and the hardware developers to incorporate his noise functions into their chipsets. How useful does John think this will be?

John Carmack: At the Hardcore Game Developer's Conference, Ken was giving his talk and he asked the (intended to be rhetorical) question "Who here doesn't think this is a good idea for hardware?" I actually raised my hand. It's not that I have anything against noise functions (although I will admit a bit of a bent towards raw data over proceduralism), but that I am keenly aware of the effect of adding extra features. Even a good or harmless feature will have some impact on the pace of shipping a product, and I would rather have whatever engineering and driver writing effort would have gone to supporting noise functions, instead go to stabilizing and optimizing the existing features. Or work on something truly important, like really solving the shade tree temporary problem in an acceptable fashion, or adding more bits of precision. Heck, more bits of precision are practically a requirement for doing most of the crazy synthesist things you do with lots of noise functions.

Gabe Newell; Valve Software: What advice would he give other developers to help preempt patent litigation?

John Carmack: I just don't know what to do about software patents. There probably isn't another issue that can make me feel so helplessly frustrated.

Patents are supposed to help promote invention and allow benefits to accrue to inventors. By most definitions, I would be considered an "inventor" of sorts, and patents sure as hell aren't helping me out.

The idea that I can be presented with a problem, set out to logically solve it with the tools at hand, and wind up with a program that could not be legally used because someone else followed the same logical steps some years ago and filed for a patent on it is horrifying.

To laymen, all of programming is alchemy, and trying to convince them that any given software patent is "obvious" or "clearly follows from the problem" is really tough.

The only way to fight it is with legal and political means, and I don't have the skills or tools to even formulate a plan of attack. I give money to causes that try to fight those battles.

The only scenario that I can see would be to have enough truly, blatantly stupid patents prosecuted that someone could make a stand in congress and show the public in an understandable way just how wrong it is.

On a personal level, I refuse to patent anything that I am involved in. Anyone that has ever gotten an idea based on any of my work and done something better with it - good for you.

Chris Rhinehart; Human Head Studios: From what I've read, Doom3 is intended to have a strong single-player experience. What do you antici-pate to be the biggest design hurdles to overcome while creating Doom3, as opposed to designing a title intended primarily for multiplayer?

John Carmack: We sort of went into Q3 thinking that the multi-player only focus was going to make the game design easier. It turned out that the lack of any good unifying concept left the level designers and artists without a good focal point, and there was more meandering around that we cared for. The hardest thing is deciding what to focus on, because DOOM meant different things to different people. We have decided to make the single player game story experience the primary focus, but many people would argue that DOOM was more about the multi-player.

Billy "Wicked" Wilson: When do you think computers will become fast enough so that developers can dump BSP based VSD algorithms for more flexible ones?

John Carmack: I think this has been mis-characterized for a long time - None of the Quake games have had what I would call a "BSP based

VSD algorithm". The visibility associated with quake is a cluster to cluster potentially visible set (PVS) algorithm, masked by an area connectivity graph (in Q2 and Q3), followed by hierarchical frustum culling (which does use the BSP). The software renderers then performed an edge based scan-line rasterization algorithm, which resulted in zero-overdraw for the world.

Early in Q1's development, I pursued "beam trees", which were truly a BSP based visibility algorithm that did exact visibility by tracking unfilled screen geometry going front to back, but the log2 complexity scaling factor lost out to the constant complexity factor from the PVS.

That highlights an important point that some graphics programmers don't appreciate properly - it is the performance of the entire system that matters, not a single metric. It is very easy to go significantly slower while drawing less primitives or with less overdraw, because you spent more time deciding which ones to not draw than it would have taken to draw them in a more optimized manner. This applies heavily to visibility culling and level of detail work, and is much more significant now with geometry processors and static meshes.

The PVS system had two significant benefits: constant time lookup, and complete automation (no designer input required).

Through Q2 and Q3, the "complete automation" advantage started to deteriorate, as designers were coerced into marking more and more things as detail brushes to speed up the processing, placing hint brushes to control the cluster sizes, or manually placing area-portals.

The principle drawbacks of the PVS are the large pre-processing time, the large storage space cost, and the static nature of the data.

The size and space drawbacks were helped with detail-brushes, which basically made a more complex map seem less complex to the visibility process, but they required the level designers to pro-actively take action. It has been interesting to watch the designers' standard practices. Almost nobody just picks a policy like "all small trim will be detail brushes". Instead, they tend to completely ignore detail brushes until the map processing time reaches their personal pain threshold. Here at Id, we usually didn't let maps take more than a half-hour to process (on our huge

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16 CPU server.), but I heard tales from other companies and the community of maps that were allowed to take overnight or all weekend to vis. That is a mistake, but the optimize-for-vis-time guidelines are not widely understood.

The static nature of a pre-computed PVS showed up most glaringly when you had your face in front of a closed door, but the game was running slow because it was drawing everything behind the door, then drawing the door on top of it. I introduced areaportals in Q2 to allow designers to explicitly allow large sections of the vis to be pruned off when an entity is in a certain state. This is much more efficient than a more generalized scheme that actually looked at geometric information.

In the Q1 timeframe, I think the PVS was a huge win, but the advantage deteriorated somewhat as the nature of the rendering datasets changed.

In any case, the gross culling in the new engine is completely different from previous engines. It does require the designers to manually placed portal brushes with some degree of intelligence, so it isn't completely automated, but I expect that for commercial grade levels, there will be less portal brushes than there currently are hint brushes. It doesn't have any significant pre-processing time, and it is an exact point-to-area, instead of cluster-to-cluster. There will probably also be an entity-state based pruning facility like areaportals, but I haven't coded it yet.

Billy "Wicked" Wilson: The shader rendering pipeline [in DOOM 3] - completely re-written from Quake III? How are you going to handle the radically different abilities of todays cards to produce a similar visual effect on each? For example I'm thinking of the presence or non presence of register combiners, and the different implemntations of these extensions.

John Carmack: The renderer is completely new, and very different in structure from previous engines. Interestingly, the interface remained fairly close for a long time, such that I was able to develop most of the DOOM renderer using the rest of Q3 almost unmodified. It finally did diverge, but still not too radically.

The theoretically ideal feature set for a 3D accelerator would be:

Many texture units to allow all the lighting calculations to be done in a single pass. I can use at least eight, and possibly more if the reflection vector math needs to burn texture units for its calculations. Even with the exact same memory subsystem, this would more than double the rendering speed over a current dual texture chip.

Flexible dependent texture reads to allow specular power function lookups and non-triangulation dependent specular interpolation. No shipping card has this yet. I was initially very excited about the possibility that the ATI Radeon would be able to do some of this, but it turns out to not quite be flexible enough. I do fault Microsoft for adopting "bumped environment mapping" as a specialized, degenerate case of dependent texture reads.

Dot3 texture blending. This is critical for bump mapping. Embossing and bump env mapping don't cut it at all. GeForce and Radeon have this now, and everyone will follow.

Flexible geometry acceleration. I can't use current geometry accelerators to calculate bumped specular, so the CPU must still touch a lot of data when that feature is enabled. Upcoming geometry processors will be powerful enough to do it all by themselves. I could also use multiple texture units to get the same effect in some cases, if the combiners are flexible enough.

Destination alpha and stencil buffer support are needed for the basic functioning of the renderer. Every modern card has this, but no game has required it yet.

The ideal card for DOOM hasn't shipped yet, but there are a couple good candidates just over the horizon. The existing cards stack up like this:

Nvidia GeForce[2]: We are using these as our primary development platform. I play some tricks with the register combiners to get a bit better quality than would be possible with a generic dual texture accelerator.

ATI Radeon: All features work properly, but I needed to disable some things in the driver. I will be working with ATI to make sure everything works as well as possible. The third texture unit will allow the general lighting path to operate a bit more efficiently than on a GeForce. Lack-

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ing the extra math of the register combiners, the specular highlights don't look as good as on a GeForce.

3DFX Voodoo4/5, S3 Savage4/2000, Matrox G400/450, ATI Rage128, Nvidia TNT[2]: Much of the visual lushness will be missing due to the lack of bump mapping, but the game won't have any gaping holes. Most of these except the V5 probably won't have enough fill-rate to be very enjoyable.

3DFX Voodoo3, S3 Savage3D/MX, Matrox G200, etc: Without a stencil buffer, much of the core capabilities of the renderer are just lost. The game will probably run, but it won't be anything like we intend it to be viewed. Almost certainly not enough fill rate.

Billy "Wicked" Wilson: The game side is C++, why not the rest of the code?

John Carmack: It's still a possibility, but I am fairly happy with how the internals of the renderer are represented in straight C code.

Gabe Newell; Valve Software: John has consistently made very clear decisions about the scope of projects id has undertaken, which I would say is one of the main reasons id has been such a consistent producer over an extended period of time. Not having spoken with John about it directly, I think I understand his rational for focusing id on the Doom project. For the benefit of other developers, are there a couple of heuristics John uses to decide what does and doesn't make sense to undertake on a given project?

John Carmack: The basic decision making process is the same for almost any choices: assess your capabilities, value goals objectively, cost estimate as well as you can, look for synergies to exploit and parasitic losses to avoid. Maximize the resulting values for an amount of effort you are willing to expend.

Computer games do have some notable aspects of their own, though. Riding the wave of Moore's Law causes timeliness to take on a couple new facets. Every once in a while, new things become possible or pragmatic for the first time, and you have an opportunity to do something that hasn't been seen before, which may be more important than lots of other factors combined.

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It also cuts the other way, where something that would have been a great return on the work involved becomes useless or even a liability when you miss your time window. Several software rendering engines fell into that category.

Billy "Wicked" Wilson: Id traditionally provides the fastest engine out there for the game types that it does. Bearing in mind that Doom3 is going to be far more single player focussed, is there any change in focus from making the engine the fastest it can be, to more of a designer / content friendly environment - bearing in mind that probably 75% of a single player content is designer built?

John Carmack: Yes. I am spending a huge amount of graphics horsepower to allow the engine to be flexible in ways that game engines have never been before. It is a little scary to drop down from the ultra-high frame rates we are used to with Q3, but I firmly believe that the power of the new engine will enable a whole new level of game content.

I am hoping that the absolute top-of-the-line system available when the game ships will be capable of running it with all features enabled and anti-aliasing on at 60hz, but even the fastest cards of today are going to have to run at fairly low resolutions to get decent frame rates. Many will choose to drop a feature or two to get some speed back, but they still won't be able to get near 60hz.

Remember, the game won't ship for a long time yet, and today's cards will seem a bit quaint by then.

Billy "Wicked" Wilson: How committed is id to producing user modifiable content? Obviously making user modifiable multiplayer games is a long way different from providing user modifiable scripting systems, producing specific animations and so on. What kind of tools will be used to create animations for instance, and will any pre-parsing tools be released to the public?

John Carmack: The decisions to integrate all tools (editor and map processing) directly into the executable, and to make map source data required for loading in addition to derived data, make the new game far and away the easiest to create content for. Every installation that can play the game can edit the game.

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Also, I have banished the last of the binary file formats, so everything (except standard data files like .wav and .tga) is now in easily explored and understood text files.

Billy "Wicked" Wilson: Given that you've made a public declaration that Id has the strongest programming team it's ever had, what's your personal role in the software development? Up til now it would appear that you've always had your hands in whatever is going on, is this going to change in the development of Doom3?

John Carmack: Jim [Dose - new programmer, formerly of Ritual] and Robert [Duffy] have large blocks of code in the new game and UI scripting that I haven't ever looked at, and Graeme's sound system will be another one. Jan Paul's bot code in Q3 is one big black box to me.

It has been a strong temptation to just say "I am working with Smart People, they can handle it", but that would not be a good plan. I need to build up more discipline about reviewing all parts of the code, because my global knowledge of all aspects of the project has always been an important part of making good decisions.

Billy "Wicked" Wilson: Has video technology advanced as quickly as you would like? Are you impressed with what nVidia, 3dfx, and others have done, or a tad frustrated (wish they have done more/made more advances)?

John Carmack: Even after all my experience, I find that I still underestimate the rate of progress. During Q3, I spent some time thinking about what could be done with stencil shadow volumes as a required feature. I thought about how the technology could be used at a reasonable cost if you designed an outdoor game, because then you would have a simple case with a single orthographic light - the sun.

That would have been a reasonable feature spec for a game shipping this christmas, but turned out to be a drastic understatement of what I wound up doing for DOOM. Eighteen months ago, I probably would have had a difficult time accepting how much hardware power the new DOOM renderer is exploiting.

Brandon Reinhart; 3DRealms: Where do you derive inspiration now

that you are the master of your industry?

John Carmack: There are some things lost as you progress through a large learning curve. Early on, there is the bewildering sense of how huge a field is. Then you move into the fun part where you have enough grounding to understand the issues, and you are constantly getting the flashes of insight as you understand the solutions that other people have developed, and you begin to formulate your own approaches.

Eventually, you reach a point where the field starts to dry up a bit, and you find that you can sometimes read an entire book and not feel that you really learned anything new. There are certainly still an infinite number of things to learn, but the mean time between epiphanies increases.

Most of the motivation remains internal. Being able to see The Right Thing, then program it into existence out of thin air is still the core wonder of programming for me.

Another way to supplement things is to start learning something from a completely different field. I have been reading Sutton's "Rocket Propulsion Elements" like I used to read Foley and Van Dam's "Computer Graphics: Principles and Practice" - practically every page has something new for me to integrate into my understanding.

Gabe Newell; Valve Software: How will you exploit a broadband only design target?

John Carmack: The biggest thing that broadband will do is just save a lot of twitchy programmer time spent optimizing for the modem straw. This will increase flexibility and let developers concentrate on making the environment and game play more fun. Clearly, that is a good thing all by itself.

Voice (probably with several optional vocoders) is a no-brainer once we get more bandwidth, and even talking-head webcam video becomes a useful possibility.

I'm not sure of the exact utility of it, but it becomes feasible to send and receive packets from multiple sources on a real-time basis, which you can't afford to do with a modem. This may enable some architectures that are more clustered instead of the binary boundary of client / server.

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Chris Rhinehart; Human Head Studios: John, you once mentioned years ago that, in hindsight, you had wished that instead of jumping right into Quake that you had combined the Doom render engine and the Quake/Quakeworld network architecture, resulting Doom multiplayer that was internet friendly. However, you also have stated that you like to start with a clean slate when beginning a new project. Are you starting with a clean slate for Doom3, or are there carryover components from Q3A?

John Carmack: With hindsight, I thought that Q1's technology could have been developed in two parts, with QC and client/server infrastructure combined with a tweaked DOOM graphics engine for one game, followed by the full 3D engine in the next game. I think that would have allowed us to produce two games in one year each, instead of spending 18 months on Q1. I still think trying to aim for one year development cycles is a good thing for developers, allowing them to be a little more daring and focused than with 2+ year cycles, but you can't change everything and still build anything in that timeframe.

All of the earlier projects, from Keen1 to Keen4 to Wolfenstein to Doom to Quake had been a completely new codebases each time, but everything since Q1 has involved significant code re-use.

Since then, we have stayed in a framework that has allowed upgrades to different parts of the codebase without rewriting everything from scratch. Its not "modular" in the sense that major improvements get dropped in without disturbing the rest, but even with hacking in lots of places to integrate significant changes, there has still been a huge amount of re-use.

GlQuake brought OpenGL rendering. QW brought new network code. Q2 brought game DLLs and the integrated and enhanced rendering DLL architecture. Q3 brought an almost completely new rendering engine and the QVM support. All of those changes were done without ever "breaking" things in a truly fundamental way.

With the new DOOM renderer, I was able to do all the rendering development with very little change to a copy of the Q3 codebase. It was forked off before the rest of the team started on the Q3 mission pack, and I had to make a few tweaks here and there, but nothing very substantial. It is a huge help to have all the existing facilities of player movement, weapons, third person, noclip, cvars, console commands, etc, all present while I

just concentrated on new rendering algorithms.

In the past couple months, the codebase has changed dramatically as Jim Dose completely gutted the old game logic, and I changed the way the entities were communicated to the renderer.

I used to take a lot of pride in the "clean sheet of paper" way of doing things, because it is obvious that there are significant dangers of complacency if you stick with a single codebase. I try to actively address that by making sure that I clearly look at what I am reusing, and make sure that it hasn't slowly become lacking for the current situation. Even simple little things that could hide away in a library forever, like file access and console completion, get looked at and improved, even when they are mostly reused.

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Chapter 12

GameSpy @ E3 - Q & A with John Carmack

This interview was conducted by Sal "Sluggo" Accardo for GameSpy on May 23, 2002.

http://archive.gamespy.com/e32002/pc/carmack/

Interview

Prologue

This has obviously been a big week for DOOM III. We've finally learned the first real details on the new game and the engine, and for those of lucky enough to attend E3, have actually seen the new engine in action. With this in mind, we were able to ask the man behind the technology – id Software's John Carmack – a few questions about the new engine, the current state of video cards, and a few other topics.

Questions

Sal "Sluggo" Accardo: It's been a few years since the release of Quake III, and other than a few appearances at QuakeCon and other shows, and a few .plan updates, we haven't heard much from you. In terms of developing the new DOOM engine (and otherwise), what have you been up to? In this day and age, how do you approach the task of building a brand new 3D engine, and where does work on the engine stand at the moment?

John Carmack: I'm not real big on the celebrity bit, so I have just been quietly going about my work.

The process of building the new engine went much more smoothly than anything we have done before, because I was able to do all the ground-work while the rest of the company worked on TeamArena. By the time they were ready to work on it, things were basically functional. I did most of the early development work with a gutted version of Quake 3, which let me write a brand new renderer without having to rewrite file access code, console code, and all the other subsystems that make up a game. After the renderer was functional and the other programmers came off of TA and Wolf, the rest of the codebase got rewritten. Especially after our move to C++, there is very little code remaining from the Q3 codebase at this point.

The fundamental strategic decisions that I made at the start of the development really haven't changed at all. My continuing effort is going into making it clean, solid, and fast. As the artists and designers have built things with the engine, we have left most of our original performance budgets behind, so performance is still a big issue (but, wow, does it look great!).

Sal "Sluggo" Accardo: The Quake 3 engine has been licensed a number of times since its creation, and many developers have built their own special additions to the engine for their games. Raven Software, in particular, has built technology like the GHOUL II system – do you take any of these systems into consideration or talk with these developers as you develop the new DOOM engine, or is the game basically being built with one game in mind and a specific set of goals?

John Carmack: I try to keep us focused on building our particular game, rather than trying to solve all the world's problems. There are some tough judgement calls to be made during development about whether something is an elegant extension of our chosen technical paradigm, or if it is unjustified work. Having the inclination and authority to just say "no" to feature requests has been an important aspect to being able to write quality code. Too many programmers agree to random feature requests without thoroughly considering the impacts. I try to err on the side of elegance in implementation, rather than feature coverage.

Sal "Sluggo" Accardo: One of the things that first attracted people to the Quake engine – and in many ways helped shape the current online gaming community – was the ability to modify the game and create entirely new games with it. Is this something that's being taken into consideration during the development of the new DOOM engine? Compared to the previous games, how easy – or hard – do you think it will be for mod makers to work with the new engine?

John Carmack: A big plus is that all of our tools are now built in to the game, so every release automatically has the tools that were used to build the game. The game also uses the same map file that the editor uses, so the original source data can be opened up with any copy of the game.

We have not yet decided exactly where we are going to break the source code for mod making, but it is certain that it is going to be a C++ DLL.

Artists are going to have a significant learning curve to properly deal with the bump maps, but again, all the tools we use to generate them are included with the game.

Level designers have to retrain themselves to use lighting more efficiently. Instead of plastering in hundreds of little lights to get your light maps the way you want, you need to think about primary key lights in a scene, and fill in around them as necessary. Cinematic lighting skills are now directly relevant.

Sal "Sluggo" Accardo: Quake 3 was essentially built as a multiplayer game, and it's been 5 years since id Software developed and released a game with a traditional single-player campaign (Quake II, 1997). Is there anything different about developing an engine for the two different styles of

games? Is there anything new or special you need to take into consideration for a single-player campaign as work on the new engine continues?

John Carmack: The core renderer is fairly agnostic to single player versus multiplayer, but many other areas of the game have to make tradeoff decisions. A latency tolerant multiplayer game needs to have all time dependent effects predictable, which forces a style of programming that isn't always the most direct. A single player game can also have more expressive and precise effects, like multiply blended skeletal animations with pivot feet, that wouldn't work out well over a network channel.

Sal "Sluggo" Accardo: The world of video cards seems to change on a daily basis. What do you think of the current crop of cards on the market, and where do you see things heading? Are there any new cards that interest you? Where would you like to see things go?

John Carmack: There are interesting things to be said about the upcoming cards, but NDAs will force me to just discuss the available cards.

In order from best to worst for Doom:

I still think that overall, the GeForce 4 Ti is the best card you can buy. It has high speed and excellent driver quality.

Based on the feature set, the Radeon 8500 should be a faster card for Doom than the GF4, because it can do the seven texture accesses that I need in a single pass, while it takes two or three passes (depending on details) on the GF4. However, in practice, the GF4 consistently runs faster due to a highly efficient implementation. For programmers, the 8500 has a much nicer fragment path than the GF4, with more general features and increased precision, but the driver quality is still quite a ways from Nvidia's, so I would be a little hesitant to use it as a primary research platform.

The GF4-MX is a very fast card for existing games, but it is less well suited to Doom, due to the lower texture unit count and the lack of vertex shaders.

On a slow CPU with all features enabled, the GF3 will be faster than the GF4-MX, because it offloads some work. On systems with CPU power to burn, the GF4 may still be faster.

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The 128 bit DDR GF2 systems will be faster than the Radeon-7500 systems, again due to low level implementation details overshadowing the extra texture unit.

The slowest cards will be the 64 bit and SDR ram GF and Radeon cards, which will really not be fast enough to play the game properly unless you run at 320x240 or so.

Sal "Sluggo" Accardo: Every once in a while, we see news that you're – quite earnestly – working with a team to build a rocket capable of blasting someone into space. From an engineering point of view, it's easy to see the fascination with the subject, but it's certainly not something to be taken lightly, nor is it an inexpensive endeavor. What was it about *this* particular project that attracted you to it?

John Carmack: There is something to be said for grappling with a challenge that only involves the forces of nature (ignoring, for the moment, the regulatory challenges), rather than consumer tastes.

The appalling inefficiency in the aerospace industry is also a bit of a driving factor. Due to an accident of history tying them to ICBMs, the evolution of space vehicles has wound up tending towards a local optimum that is in a completely different area than better global solutions, and it doesn't seem likely to break out of the current context. The aerospace industry needs a fresh reboot. There is an order of magnitude improvement available in low hanging fruit.

I have a reasonable time table going for all of our development work, and things are proceeding satisfactorily.

Chapter 13

John Carmack on DOOM3 rendering

This interview was conducted by Anthony 'Reverend' Tan for Beyond3d on Jun 06, 2002.

Interview

Prologue

id Software's demonstration of the work-in-progress of DOOM3 at the recently concluded E3 have left many breathless when it came to the graphics aspect. While John Carmack, main programmer and the man responsible for various game engines of past id Software classics, have given us his thoughts on the technological aspects and hardware requirements in past dot plan files and random postings and email replies, many are still curious about DOOM3's engine and hardware compatibility.

I'd picked a few interesting questions raised by Beyond3D forum mem-

bers, re-phrased them a little for clarity and sent them off John's way. A few of John's answers were original posted by me in a thread in the forums while some are new. I'd asked John for short, to-the-point answers since he'd said he doesn't have much time for interviews. Here we go:

Questions

Anthony 'Reverend' Tan: It appears the models are low in poly count. Knowing what I know, it would appear that the reason for this, specifically with regards to your engine, is because of the shadow volume based lighting. With higher poly counts, your engine's speed would suffer. Am I correct? And how would ATI's TruForm look?

John Carmack: The game characters are between 2000 and 6000 polygons. Some of the heads do look a little angular in tight zooms, so we may use some custom models for cinematic scenes.

Curving up the models with more polygons has a basically linear effect on performance, but making very jagged models with lots of little polygonal points would create far more silhouette edges, which could cause a disproportionate slowdown during rendering when they get close.

TruForm is not an option, because the calculated shadow silhouettes would no longer be correct.

Anthony 'Reverend' Tan: Higher precision rendering. It appears that the GF3/GF4Ti clamps the results (including intermediate ones) when some part of the calculations goes over 1.0. The Radeon 8500, with up to 8.0 higher internal ranges, can keep higher numbers in the registers when combining, which allows for better lighting dynamics. How much will this have an impact in DOOM3's graphics?

John Carmack: At the moment, it has no impact. The DOOM engine performs some pre modulation and post scaling to support arbitrarily bright light values without clamping at the expense of dynamically tossing low order precision bits, but so far, the level designers aren't taking much advantage of this. If they do (and it is a good feature!), I can allow the ATI to do this internally without losing the precision bits, as well as saving a

tiny bit of speed.

Anthony 'Reverend' Tan: Multiple passes. You mentioned that in theory the Radeon8500 should be faster with the number of textures you need (doing it in a single pass) but that the GF4Ti is consistently faster in practice even though it has to perform 2 or 3 passes. Could this be due to latency? While there is savings in bandwidth, there must be a cost in latency, especially performing 7 textures reads in a single shader unit.

John Carmack: No, latency should not be a problem, unless they have mis-sized some internal buffers. Dividing up a fixed texture cache among six textures might well be an issue, though. It seems like the nvidia cards are significantly faster on very simple rendering, and our stencil shadow volumes take up quite a bit of time.

Several hardware vendors have poorly targeted their control logic and memory interfaces under the assumption that high texture counts will be used on the bulk of the pixels. While stencil shadow volumes with zero textures are an extreme case, almost every game of note does a lot of single texture passes for blended effects.

Anthony 'Reverend' Tan: As I understand it, DOOM3's rendering pipeline works by, first, rendering the complete scene without ambient light nor textures (so that this pass is very quick) and then filling the z-buffer with correct (and final) depth information for each pixel on screen and z-writes are turned off.

John Carmack: Yes.

Anthony 'Reverend' Tan: And then, for each per pixel light : 1. Render shadow volumes of all shadow casters into stencil buffer. This is again a quick pass (no textures used), but potential fill rate burn because of overdraw (btw, what sort of optimizations are you doing to reduce overdraw?). 2. Add light contribution to pixels that have stencil=0 (when they are not in shadow). This looks something like this for diffuse point light: Temp=NormalMap dot3 LightDirection Temp=Temp mul AttenuationMap Temp=Temp mul LightColor Result=Temp mul MaterialTexture

John Carmack: That is basically correct for the diffuse map, although you have to sort by light and clear the effected regions of the stencil buffer as

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well. Adding the specular map requires a half angle cube map, another access of the normal map, some random math, and a specular map access.

There are some subtleties with sorting to allow some extra shadowing features, but they aren't critical aspects.

Anthony 'Reverend' Tan: Basically, your engine draws z-buffer in one quick pass and then the z buffer does not change anymore. Total number of render passes is (greatly) influenced by the number of per pixel lights used. Correct?

John Carmack: Yes.

Anthony 'Reverend' Tan: You said there are two passes on GeForce 3/4 and one on Radeon 8500. Are these number of passes *per light*? Say we take 30fps as basis - GeForce3 or 4 could handle about 3 or 4 per pixel lights per frame which actually means 8-10 passes! Radeon 8500 would take 5-6 passes which saves some T&L work. Again, correct?

John Carmack: Yes, the primitive code path is a surface+light "interaction". We guestimate 2x lights per surface average and 2x true overdraw, for 4x interaction overdraw (times 5,3,2,or 1 passes, depending on the card and features enabled).

Anthony 'Reverend' Tan: The Kyro (or specifically, the Kyro2). With lack of cubemap support, and with LightDirection being a cube map texture, would disabling per pixel normalization of LightDirection enable the Kyro2 to run DOOM3? Would you do this?

John Carmack: I doubt it, but if they impress me with a very high performance OpenGL implementation, I might consider it.

Anthony 'Reverend' Tan: GeForce1/GeForce2/Radeon7500. All would be able to run DOOM3 at lower resolutions with fewer per pixel lights per frame. What about per pixel normalized LightDirection? No cube maps and LightDirection can be stored in diffuse or specular color component of vertex but I'd appreciate a clarification/confirmation from you.

John Carmack: That is actually on my list of things to benchmark, but I rather doubt it will make a difference. I don't think there are enough

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combiners on a GF1/2 to do it, and I don't expect much of a speedup by skipping a rather low-res cube map access on GF3/4.

John Carmack

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Chapter 14

GameSpy @ QuakeCon 2003 - A Conversation With John Carmack

This interview was conducted by Steven Kent for GameSpy on Aug 16, 2003.

Interview

Prologue

John Carmack sits at the end of an enormous boardroom table in a hotel conference room. He has the room to himself, and that seems like a good arrangement by him. The occasion is QuakeCon, and people have traveled in from around the country, computers in tow, to celebrate the games Carmack helped create.

On this occasion, John Carmack seems very satisfied, and that is something to worry about. In the book "Masters of DOOM," author David Kushner mentions questions about Carmack retiring. With the DOOM 3 engine complete and news that Raven, not id, will create Quake IV, per-

haps Carmack is ready to retire.

Fortunately, in his current mood, no subjects were off limits:

Questions

Steven Kent: Are you going to retire after DOOM 3?

John Carmack: No. I've got at least one more rendering engine to write. The development of rendering engines is driven by two major factors. One of these is, of course, the question, "When you finish a game, is it time to write a new engine?" The answer is based on what is happening in the hardware space.

Previously, it was just about what was happening on CPUs. Do we have 32-bit CPUs? Do they have floating point on the CPUs? Then we got graphics cards and that stayed the same for a number of years. We got some important new features in the graphics which basically engendered the DOOM engine. We had cube-mapping, dot re-rendering, and geometry acceleration. This important set of features, and it was enough to make it worth writing a new engine.

DOOM is going to be in use for a long time, but just this year, hardware has surpassed a really significant point with the floating point pixel formats and generalized dependent texture reads. These are things that demand that a new engine is written.

It's particularly significant because those are the only features that are necessary with temporary buffering to actually implement anything. You can decompose Pixar Renderman shaders into multi-passes. It doesn't mean that they can run in real time, but the fact that they can be calculated on a graphics card has a wide range of implications on what you want to do for the graphics pipeline. It's going to impact both real-time rendering and off-line rendering. There is going to be an interesting convergence.

DOOM does a lot of things to use these features, but it still uses that notchy functionality of previous generation graphics cards where you

had this set of features and you could use combinations of them but you could not do exactly what you want.

The very latest set of cards, with the combination of those features – floating point and dependent texture reads and the ability to use intermediaries – you can now write really generalized things and that is appropriate. You might use 50 or 100 potential instructions in some really complex gaming shader; but if the engine is architected right, you would be able to use the exact same engine, media creation, and framework and architect the whole thing to do TV-quality or eventually even movie-quality rendering that might use thousands of instructions and render ridiculous resolutions. The ability to use the same tools for that entire spectrum is going to be a little different from what we have now.

Steven Kent: How long does it take to create an engine?

John Carmack: The DOOM rendering engine went surprisingly smoothly, I mean more so than almost any other thing that I have done before. I made absolutely the right calls at the early strategic level. It was good fortune.

I look back at that and see that the very real decisions about what the core rendering technology was going to be, how the architecture was going to be, and what the external interface was going to be did not change in over two years in a fundamental way. I had the core of it done two years ago. We could render a picture and it looks like what the DOOM engine does.

It took another year to add all of the features, but fundamentally, it has not changed in a year. There have been a few changes, a few little optimizations, but mostly it's the rest of the game coming up to par-getting the game technology there, the game system and all of the characters, and the things that make it a real game.

Steven Kent: I am surprised that you do not see Quake IV using this next generation engine.

John Carmack: Wolfenstein worked out so spectacularly well. Inside id there is a group that really, really does not want to do another sequel. Our next game is not going to be a DOOM, Quake, or Wolfenstein sequel, it's going to be something new and that is a foregone conclusion.

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WITH JOHN CARMACK

We knew that we were going to license that out and let someone do it.

The work that was done with Wolfenstein, in the end it turned out great, of course, everybody loves it, but it was painful during the development. At one point we had every programmer at id working, trying to stabilize the code base to make things okay for shipping.

But still, we looked at that as a success and we are hoping to replicate that success with Raven doing Quake IV. Raven has always been our lead engine adopter. It was a foregone conclusion that Raven would get the Doom engine early, the only question was what they were going to work on.

Steven Kent: Do you see yourself ever straying away from FPS games?

John Carmack: John Carmack: Occasionally I desire to do a different kind of game. To a large degree, id Software is a prisoner of its own success. Because we are a single-title company, we have a strong obligation to do something that has relatively low risk.

With game development taking multiple years and costing many millions of dollars I think real innovation will not necessarily come from triple-A titles. Triple-A titles have so much of an investment that it engenders a huge risk-aversion. I think that the real innovation will come from things that are done on a smaller budget, that might be targeted as budget titles. It's okay to risk $500,000 on a development budget where you might say, "This is a clever idea, lets give it a try." Risking $10 million dollars, and some development budgets are going well over that already, is a lot harder.

Even going to another style of game, we have an obligation to make sure that our current distribution of artists, level designers, and programmers are gainfully employed on the next project. We are built around doing first-person shooters with this mix of content creation.

Steven Kent: Let's switch topics from your job to your hobby. Can you make a rocket to take two people in orbit?

John Carmack: Orbital is a lot more challenging. The X-Prize is about going up 100 kilometers and coming back down. You leave the atmosphere. You enter space and you remain weightless for 10 minutes or

so. You come back in and it's the world's tallest roller coaster ride. That would require about one-eighth of the energy required to go into orbit.

The X-Prize is absolutely obtainable. It is obtainable next year. There is little doubt in the technical ability on that and I think things are okay on the regulatory side. There are issues that we are working there, but we have plans and fallback plans.

Getting there is more fundamentally difficult, but it is not impossible. Rocket science has a mythology about it that isn't correct. Because of the way things evolved, we got our gigantic, expendable space vehicles.

There is a wonderful analogy here with gaming. Remember when I said that we are trapped by our own success? We have something that works. We serve a market. We have a continuing customer base and with a $10 million budget, you can't F*** around with this.

Elevate that to the orders of magnitude in the aerospace industry. You have a stable customer base. This satellite costs $500 million, do we want to try a little experiment to see if we can do something a little bit better? They are completely stuck.

It doesn't have to be that expensive, but they are not going to make it cheaper because they are in this way where it is stable and profitable. Doing something off the wall is going to need to come from a lower tier, just as it will with the gaming industry.

The only difference is that gaming and computer entertainment are vibrant and competitive. You have hundreds and hundreds of little teams doing this. Aerospace is not. You have two or three monoliths and a few government contractors.

It's weird being in a company that is part of the stable establishment, but we are. We're kind of the blue chips. We're the Boeing of the first-person shooters. It constrains us, but we are.

Steven Kent: Thesis and anti-thesis become synthesis. Id was once the anti-thesis of the established game order. Now you and the Nintendos of the world have merged to create a new order that can only be challenged by new small companies.

John Carmack: It's fun being part of the scrappy little start up with rockets.

I am different than a lot of people in the space community in that I am not this life-long visionary about all that. I had a normal geek childhood with science fiction and model rockets, but I didn't think about space for a decade. It's mostly an engineering challenge to me.

Steven Kent: As a triple-A company, can id work on any smaller ideas?

John Carmack: I thought it would be kind of neat if we took the DOOM renderer, and we had a team take previous games-don't touch the game, just revamp it graphically. Just take Quake II, and just use the DOOM engine to make brand new graphic models and everything. But don't spend time messing with the gameplay because we know that is pretty good. Just release it as Quake II Remix with brand new graphics technology and sell it at a middle-level price instead of a boutique price.

I thought that was a pretty good idea.

Chapter 15

DooM III Preview

This interview was conducted by PC Zone Staff for Computer and Video Games on Oct 23, 2003.

http://www.computerandvideogames.com/article.php?id=97758

Interview

Prologue

Some say he's the greatest programmer alive. Others call him a visionary genius who single-handedly drags games technology into the future with his audacious talent. Since we wouldn't know a string of C-code from a string of lean beef snarlers, we could hardly comment on that, but we do know one thing - John Carmack has coded some of the best games ever made. Wolf 3D, Doom, Quake - hell, he practically invented the FPS.

These days, the Mack Daddy of rendering doesn't emerge from his subterranean lair very often, and PC ZONE was the only UK magazine to secure an interview at QuakeCon 2003. It's too big for one magazine, so we've had to split it across a couple of issues. Part one starts right here, so without further ado, over to the big man...

Questions

PC Zone Staff: How close is Doom 3 to completion?

John Carmack: We're really close. The last level was completed recently, but there's a huge amount of tuning that needs to be done. We've got a few levels, like the ones shown in the demo that are pretty much at the level of polish we're looking for throughout the game. But the other 20-some odd levels are not there yet.

PC Zone Staff: How critical are the next few months going to be?

John Carmack: In some ways this is the most important time of development. The tools are all there, everything's at our disposal, everything's basically working. Now's where it goes from being an interesting demonstration of all the technologies to being a fabulous game, and that really does all happen at the end.I recently counted up the number of things we have to tune between pulling a trigger and hitting something with a projectile, and there's 32 effects that we have going on between there. There's the muzzle flash model, the light from there, the kick of the gun, the kick on the view, the sound on the muzzle flash, the sound on the projectile, the light on the projectile, the particles from the projectile, the pain animation that the monster gets hit by, the knock-back that he gets, the blood spray that comes off of it, the decal that gets put on it, the pass-through that goes on to the wall, the shell that comes out of the gun - you know, it's this huge list. You look back at the really early games where it's like, OK, you had an animation that happened there as a little muzzle flash and then the guy went into a pain animation, and that was it. So, there are a lot of dimensions that we have at our disposal for tuning, and you're not going to get everything perfect, but you feel an obligation to at least try and explore the solution space a little bit to try and hit on the really good things.

PC Zone Staff: So is it at the stage now where your personal involvement on the game is a little bit less?

John Carmack: Actually this entire past year I haven't been the most critical person on the team, because the development of the rendering engine went smoother than really any I've ever done before. It turns out

that the decisions I made at the very beginning about how the implementation was going to be, what the features were going to be, what the interface was going to be - they were all really good. Normally there's lots of evolution and major changes that go on, but the original architecture for the Doom 3 renderer has stayed pretty damn constant. Two years ago it was rendering pictures that look basically like our pictures today. One year ago it was feature-complete. This past year has been adding tweaks and some optimisations to things, but really at this point I'm hesitant to make too many major changes because it's really good right now, I don't want to screw it up.

PC Zone Staff: What's your main responsibility on the game now then?

John Carmack: I've actually been back in recently doing some more of the game code, which is not what I ever intended to do, but I'm almost sort of twiddling my thumbs sometimes. It's more difficult now, because in previous games all the code was spawned by me. I wrote the base of everything and then other programmers would take over and extend the things, but I still put everything in its original places so it was easy for me to jump in and quickly diagnose any problems or add any feature. Doom 3 is the first game that started out with multiple programmers writing brand new code.In Quake III we wound up pulling in a big block of code that Jan Paul [van Waveren, the Dutch programming whiz headhunted by id from the Quake editing community] wrote for the bots, but that was an emergency measure at the end, because of the way that whole thing worked out. So there's this block of stuff in Quake III that I really know nothing about. But with Doom 3 we had many programmers writing brand new sub-systems, and I don't necessarily always agree with how some of the things are implemented. So I'm not in a position where I can just jump in and grab anything off the 'to-do' list and go and fix a problem in the game code. But I did recently finally start getting back into carving off some sections of the game code and fixing it up and making it more the way I'd like it to be. I'll probably be doing some more of that. But there's a huge loss in productivity once you go from a project that one person basically created the bulk of to something that has lots of people working on it. We've had five programmers working almost from the beginning on Doom 3, and it might have twice as many features as if I had done everything, but it has like ten times the problems. You pay

more labour for more features, but you get features that you wouldn't have got otherwise. The classic case that I'll hold up, as a perfect example of something I wouldn't have done that turned out really good, is the ragdoll physics for deaths that Jan Paul really pushed for. That's the type of feature that I never would have implemented.

PC Zone Staff: Why's that? We can't get enough of those kooky ragdolls...

John Carmack: Physics code is among the twitchiest stuff to put into a game engine, because it's not as deterministic and able to be nailed down. It is a pretty significant performance drag, and for two years now in Doom 3 we've had cases where it's like, 'the game is stuck at seven frames per second, what the hell?' and it's because a ragdoll is stuck and not going into a quiescent state. There's all these sets of problems that I knew would be problems, and were. But they were able to be solved, and now the ragdolls are a good feature.

PC Zone Staff: Do you fret a bit about losing a certain level of control over the development process?

John Carmack: I'm at peace with the situation. It was a known strategic decision. For one thing I'm not spending all my time at id anymore, because I'm doing the Armadillo stuff with a good chunk of my time [Armadillo Aerospace, John's rocket science project]. So the company has to get by without me, and even if I was still spending 80 hours a week at id, you'd just eventually reach a point where one person functionally cannot do all the features that you want to have on there.

PC Zone Staff: I was talking to Tim and Todd earlier about the involvement of UK developer Splash Damage on the Doom multiplayer. How's that working out?

John Carmack: Well, we always knew that we were going to be, intentionally, giving multiplayer short shrift in Doom 3. It's a single-player game, that's what we're building everything around, and the multiplayer is going to be present, but not a focus. So it's probably a good thing that we're getting an outside team to go ahead and make it their focus. Otherwise it would have been essentially the level of capability that Quake II had, where you had like five levels that were hashed out in a week from somebody. So now we're going to get some good stuff with really good

playtesting in it.

PC Zone Staff: You've been doing this stuff for more than a decade now, making dark and disturbing first-person shooters. What keeps you going and what keeps it interesting?

John Carmack: Well, to some degree we are trapped by our success. Because we're a single-product company, and we have 20-some odd employees that we pay very well, we don't have the freedom to go off on some complete lark and try some random thing. The products that we spend time on have to have a high probability of success, and they also have to use the same mix of artists, level designers and programmers that we have. It's not in our cards to go and say, 'well, we really only need one designer for this project, we'll fire four level designers'. We just wouldn't do that.

PC Zone Staff: Are you ever tempted to try something completely different?

John Carmack: Well, I'm doing Armadillo Aerospace, so yes, you could say the temptation is there on some level [laughs]. Game-wise, I'll occasionally have some random thoughts about doing something different, but the first-person shooters have been good from a technical-challenge level, with the combination of networking and sound with the graphics and the structuring and architecting of the things. It's been rewarding on that level. And that's my primary motivation really - the engineering challenge. Making interesting things work as new capabilities arrive, as the hardware provides it to us.

PC Zone Staff: Are you anticipating any media controversy to follow the release of Doom 3, as you've suffered with many of your previous games?

John Carmack: I would have thought that stuff had been played out. The media every once in a while is like, 'Hmm, what are we going to do now... Let's pick on violent videogames.' I wouldn't be surprised though. External events again are going to be the driver. If there's any other... ah, Columbine sort of thing, I'm sure it will come up again. I don't think we're going to get too much of it, but I could be wrong. It's not my area.

PC Zone Staff: We noticed one undiscussed item on the multiplayer weapons

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menu - the Soulcube. Can you tell us about this item and any other power-ups we don't know about?

John Carmack: The Soulcube is a hell artifact from the later part of the game. There are some other power-ups that you haven't seen yet, but the multiplayer is not going to have all the power-ups that people expect on there - it's not hugely focused on that. There will be a few other things with some interesting effects, but that's not a focus in the multiplayer.

Chapter 16

Doom 3, basketball and the future of everything

This interview was conducted by PC Zone Staff for Computer and Video Games on Oct 31, 2003.

http://www.computerandvideogames.com/article.php?id=98036

Interview

Prologue

Last month, we kept it simple. We shot the breeze with John about ragdolls and hell artifacts, how happy he is with the game and how things have changed since the olden days. But really, we were just warming up. This month, we give the world's most-famous code-jockey the reins, hanging on for grim death as he vents his views on innovation, graphics technology and manned space flight...

Questions

PC Zone Staff: So, John, id's games have signalled generational leaps in gaming technology more than once. Do you see Doom 3 as an equally big leap as Doom or Quake?

John Carmack: Yes. We had a few evolutionary steps where we had Quake II and III - obvious evolutions of Quake. Even though Quake III was a completely different rendering engine, it was still in the same paradigm, which was light-mapped worlds and single point-shaded characters.Before each new game, I take stock of where I think the hardware's going, what we've got now and what's coming out in the time until we release the game. That's what drives the decision of when it's time to write a new engine. It's not like I've got some brilliant new way of structuring things, it is driven by the external forces. And people who ignore that suffer miserably, like the people who were doing voxel engines right as 3D hardware engines were coming on. So as we went through Q2 and Q3, I was like OK, we're starting to get hardware acceleration here, but can we rely on it, does it fundamentally change the way we do the rendering? And it didn't. With Q3 we were able to say 'hardware accelerated only', but the things we could do with that hardware were still basically the things we were doing in previous generations. We could just do it more concisely, faster, higher colour, all those various things. When it was time to look at the Doom 3 stuff, I investigated five different directions for rendering post-Quake III. Some of them would have given much higher quality renderings of static environments. It's not an exaggeration that we can do photo-realistic renderings of static environments and move through them. But, when you then paste dynamic objects on to those static scenes, they're clearly in this separate plane. You've got your moving thingy and your environment. And I thought it was more important as a game technology, which is about interactive things, that we followed this other opportunity. Instead of pursuing ultimate detail on the environments, we could unify all the lighting and surfaces, which is the big thing for Doom 3. So that was the core decision to be made, and I look back at that and, more than any other game I've done, I think those initial decisions and the initial technology layout were exactly right. Looking at things today, there's a clear generational step.

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PC Zone Staff: What's the next step then?

John Carmack: The next step is actually ready to be written now. Again, driven by external hardware things, we had a couple of important inflection points happen in hardware with the latest generation - the floating-point pixel formats and the generalised dependent texture reads and flexible fragment programming. Those three things combine with floating point buffers to allow us to synthesise any equation by decomposing it into multiple passes.

PC Zone Staff: Come again?

John Carmack: Previously, without the floating-point you would always start losing lower order bits of precision because you've done so many calculations on some of these things. Even in Doom 3 it's a significant problem - it starts showing up as some artifacts that can be pointed out in the game. Even if you had infinitely fast hardware of previous generations, you couldn't do a hundred-pass computation because you've only got eight bits of precision and it'll turn to mud after a certain number of combinations. But with the floating-point calculations you can then arbitrarily decompose this and do, if necessary, hundreds of thousands of calculations. And this is hugely interesting.

PC Zone Staff: It is?

John Carmack: Yes. There was an important paper that came out at SIG-GRAPH a few years ago by someone at SGI [Silicon Graphics]. He presented one real-time renderer and he presented something that showed the decomposition of Renderman shaders into multi-pass stuff that required floating-point and pixel stuff. It was amusing because I remember people completely discounting that paper, which I think is going to be looked back at as one of the most seminal things in interactive graphics. People were saying the Renderman shader was ridiculous - it took 500 passes to do this simple shader. People just hit this number - 500 passes, and clicked it out of their brain as not relevant. But a pixel in Doom 3 may have 80 textures combined on to it. Depending on whether things are done completely in calculations or not, it may have up to seven textures per light on each surface. You may have a surface with three lights shining on it, that's 21 textures, and you might have three levels of things drawn behind that, and then you might have 50 shadow planes going be-

tween them, so we can pile up over 100 operations per pixel right now. So suddenly 500 for every surface layer is maybe a generation or two away, but it's not that far off. Exponential paces are difficult to come to grips with.

PC Zone Staff: OK... So, do you think Doom 3's gameplay would be as interesting if it wasn't for the new technology?

John Carmack: We decided Doom 3's gameplay is not going to be some wild innovation - it's a first-person shooter. There are a lot of arguments that can be made about game design, and I prefer simplicity and elegance. There are big arguments that happen inside id over 'do we wanna have an additional control for something like this?', and I'm always the one saying we want the minimum number of everything, because I want it to be simple and fun to play. I think the GUI interaction in the game is really powerful as an interactive paradigm. It doesn't require additional controls; you're interacting with something people are familiar with. Allowing you to interact with complex displays is powerful, much more than adding three more keys to do something.In terms of the basic gameplay, the first-person shooter is a genre that will probably be around forever now, like flight sims and driving games. There are plenty of branches you can take within that, like pure realism, tournament play, comic action. And I think the push for people to innovate in gameplay - I'm not sure that I particularly agree with it. You don't go around constantly coming up with new basketball games. What we have the ability to do is improve the playground you're playing on in these fundamental ways, and it's a good thing. We've got some neat things where you can control some big machines and do some cool stuff, but it is still a 'running a person around, shooting at things in the world' game, and I didn't want to make it anything other than that. We have vehicle code in there that I know Splash Damage is playing with and making buggies and stuff fly around, but I'm most mistrustful of adding that sort of thing.

PC Zone Staff: Now you've got the per-poly hit detection in the game, will all player models have to comply to a strict surface area in multiplayer matches?

John Carmack: It's going to be a factor, because yes, that matters. When we first put it in the game, we took the same damage levels from Quake

III, and we started playing against it - you just couldn't kill people! They occupy like one-third the surface area of their bounding box, and it just takes a long time to hit people. The damage levels have been upped a lot - it probably makes aiming for splashes more important. But yes, it probably will have some effect on the models. People who are playing competitively will probably play with the lock-down original models. But because the multiplayer is peer-to-peer, where you join together at the start, it will have a different general dynamic from the Quake servers. You won't see people randomly joining in the middle of a game.

PC Zone Staff: From Doom to rockets, what's the latest on your experimental rocketry project, Armadillo Aerospace?

John Carmack: We're probably six months behind because of the propellant situation. Here I am, trying to buy $150,000 worth of rocket-grade peroxide, and here is a big chemical company that's losing money, but are more scared of something happening and being sued. But our sub-scale vehicle is ready to fly and our big vehicle is very close to flight form as well. We bought a Russian space suit off Ebay and we're going to modify that.

PC Zone Staff: What's the goal then? Orbit?

John Carmack: We're aiming for the X PRIZE. It's a $10million prize to launch three people to 100km. You go up, you get 10 minutes of weightlessness in space, and you go through re-entry - it's basically the world's tallest roller-coaster, and you have to repeat it twice in two weeks.

PC Zone Staff: Are you going up?

John Carmack: It would be fun, but it's not something I'm really driven to do. And my wife is vigorously opposed to the concept.

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Chapter 17

Interview with id Software's John Carmack on Doom3

This interview was conducted by Anthony 'Reverend' Tan for Beyond3d on Aug 10, 2004.

Interview

Prologue

Probably the most eagerly-anticipated game for a number of years is upon us. Four years in development, Doom3 is the latest game by Mesquite-based id Software, a game that id says is the best they have ever done. While the reception to its gameplay is mixed (as is always the case for such a subjective topic of discussion), the majority is in agreement that it is the best looking game ever released on the PC platform.

This reporter, finally getting his hands on a copy of the game after a torturous wait, has been corresponding with id's Technical Director, John

Carmack, the man responsible for the engine powering Doom3, on a variety of topics concerning the game. Deciding that the information generated from these correspondences could prove useful to the public, a request was made to turn these correspondences into an unofficial interview and John gave the go-ahead to this "interviewer" (although he voiced his concern to this interviewer that this "interview" may incite lots of other people to send him more emails!).

Some of the following information have been provided by this interviewer in Beyond3D's various forums, scattered as they may be due to the nature of Beyond3D's forums where there are individual forums for discussing technologies and games. The hope is this "interview" would be a single source of information that touches on a few matters raised by this interviewer to John. Let's not waste anymore time.

Questions

Anthony 'Reverend' Tan: It appears that benchmarking demos (using the "timedemo" command) results in higher performance stats than actual gameplay. Can you explain to me why is this so, regarding the "timedemo" command? Is it because "timedemo" do no calculate AI and physics? What else? Also, if I run in a straight line in normal gameplay and have that entire run logged, total frames is higher than a recorded demo of that same run. Why is this?

John Carmack: Timedemo doesn't do any game logic.

Demos are always recorded at exactly 30Hz.

Anthony 'Reverend' Tan: Okay, timedemo only tests graphics rendering and ignores AI and physics. Even with a high-end CPU system, I have found that timedemo is still very CPU-dependent. In demos with many monsters and/or large/complex monsters, I will have to assume this CPU-dependency in timedemos is a result of CPU skinning (since AI and physics are ignored in timedemo). Correct?

John Carmack: CPU skinning, shadow generation, and tangent space reconstruction are the parts of Doom that take up significant time in

timedemos, but there is a lot of driver overhead as well.

"r_skipRenderContext 1" will unbind the gl context, so all driver calls become null functions. You can have some timings activated, then enable this, then disable it so things draw again, and compare to see how much time is spent in the driver, assuming the scene is not hardware limited.

Anthony 'Reverend' Tan: What's the situation with regards to depth bounds test implementation in the game? Doesn't appear to have any effect on a NV35 or NV40 using the cvar.

John Carmack: Nvidia claims some improvement, but it might require unreleased drivers. It's not a big deal one way or another.

Anthony 'Reverend' Tan: There are several rendering paths. How do we get to set specific path to use?

John Carmack: "r_renderer [arb | nv10 | nv20 | r200 | arb2]"

Anthony 'Reverend' Tan: (A thread in our forums shows an ATI employee improving performance on ATI hardware by changing a Doom3 shader. There have been widespread discussions on this, not only in that particular Beyond3D thread but on other public forums as well. Please visit this forum post to understand the reasoning behind the following 2 questions. This interviewer pointed John Carmack to that particular forum thread, as did the individual which started the thread.)

Now, without taking anything away from that guy for experimentations, something must be up because:

1) I can't believe you didn't think of this :) ; and 2) You couldn't do that because it (probably) affects some other stuff (specific lookup tables, for instance)

Any comments on what might be actually happening?

John Carmack: The ARB2 path uses a lookup that exactly matches the bias / square calculations used by the NV10 / NV20 / R200 paths so the surfaces look the same in the different rendering modes.

Anthony 'Reverend' Tan: Does that mean you're using different lookups for different materials? What exponent exactly are you trying to approxi-

mate?

John Carmack: The specular function in Doom isn't a power function, it is a series of clamped biases and squares that looks something like a power function, which is all that could be done on earlier hardware without fragment programs. Because all the artwork and levels had been done with that particular function, we thought it best to mimic it exactly when we got fragment program capable hardware. If I had known how much longer Doom was going to take to ship from that time, I might have considered differently.

It should be noted that a power function is a strictly empirical approximation of a surface's specular response, so other specular approximations shouldn't be looked at as just approximating a power function. For instance, especially for broad highlights, it is nice to have a finite cutoff angle, rather than the power limit approach.

The lookup table is constant in Doom, so there isn't any real strong argument against replacing it with code. The lookup table was faster than doing the exact sequence of math ops that the table encodes, but I can certainly believe that a single power function is faster than the table lookup.

Chapter 18

"Meet the Graphics Guy" - PC Gamer interviews John Carmack on the future of iD.

This interview was conducted by PC Gamer for PC Gamer on Jan 01, 2006.

Interview

Prologue

Industry leaders dictate their own terms: so it is with John Carmack. Legend states that the id founder and programming genius is a workaholic, coding well into the evening. It is 1am in Texas, his home-town. The world is sleeping, yet this is the time chosen by John to talk.

Carmack's career has never been less than astonishing. His code has consistently wrought new opportunities. One of his first projects was to build a side-scrolling routine for the early IBM PCs. As a joke, and to prove his routines potential, Carmack and his friend Tom Hall reproduced the

entire first level of Super Mario Brothers 3 over the course of one long evening. That scrolling technology formed the basis of the first Commander Keen game; the title that would eventually lead to Wolfenstein 3D, the Doom and Quake series.

Carmack is undergoing a similar creative resurgence. His own curiosity has led him to the under-powered, under-appreciated world of mobile phone gaming. He's been working on a conversion of Doom for handsets; a task he picked up to sate his own curiosity. That work has implications for the wider world of gaming - implications that John is more than happy to discuss.

John speaks with a rare focus and control. Each answer feels not thought out, but parsed. He cuts directly through to the issues that id, and the PC face, without attempting to obfuscate or misdirect. He is a fascinating subject: concerned not just with technology, but with game design and the business reasoning behind the games industry.

Questions

PC Gamer: The world associates John Carmack with the technology, rather than game design. Is that fair?

John Carmack: I think a lot of people have always associated id with technology, but not game design, but that's a surface view that doesn't capture a lot of the important things. Game design isn't necessarily a case of piling things on. A lot of game design is about deciding what you don't need. There is an elegance and beauty in simplicity which has made a lot of id games very successful. That actually is an element of design, it's not throwing everything and the kitchen sink in, it's putting in the right things so that there's an elegance to it.

As an engineer I strive to do that type of stuff in the design side of things. In the mobile platform, because you don't have the resources, it encourages that type of clear headed thinking.

PC Gamer: How much say do you have in what goes into an id game?

John Carmack: I don't. Not anymore. Post Quake 3 I've stepped a little bit back from the design side on the PC space because I'm really not representative of what most of our market is now. I did realise that my very simplified game design ethic is not really what the market is demanding.

Internally, Quake 3 was viewed as my game. It was a game I wanted to play. It was the id game that I probably spent the most time playing and enjoyed the most, but it was actually one of our less successful titles. The focused minimalism is appealing for me, but probably isn't the best direction for a top-flight commercial game company.

I'm no longer in there vetoing things getting added to the game design. That's probably one of the reasons why Doom might have taken longer to ship, but it was a richer game for it.

PC Gamer: Id have always created first person games, since your very early shareware stuff. What's so great about that genre?

John Carmack: Once you make the decision to come out of 2D and into 3D you've got the fundamental choice between first person and third person. I think what it breaks down to is that first person is more immersive, you can have more visceral effects, while third person is more cinematic. I would even say that maybe, third person may be a more popular genre, because you've got a lot more cinematic heritage to fall back on, and it's more of a storytelling, rather than playing experience. Third person games that have your character at the bottom of the screen, though, are not nearly as strong for gameplay reasons. They don't have the shock, they don't let us do as much to the player. Certainly, many companies are successful with their third person games, but I don't feel that we, as a company, or as the individuals that make up the company, have the cinematic underpinnings amongst us to do what would be an epic third person game.

PC Gamer: Why mobile phone games?

John Carmack: It started out as something I thought was interesting, and might be fun to do, and I found a business rationalisation for it. I bought a mobile phone recently, and saw that it could run Java. Java's an open platform, it's very easy for me to go onto the web, grab development kits, and put together a few little toy applications. I started kicking around a

few ideas, well, if this is reasonably straight forward, and it's obviously a small platform, maybe it would be reasonable to actually do a product for it.

I spent a little while thinking of what would fit on the platform. That was one of the things I saw was wrong with most of the games that were already there: they were taking something that might work on another platform and just cramming it on the mobile device without any real regard for what actually plays well from a users perspective. I went through a bunch of different concepts, but the one I settled on was using a 3D engine, because that's the thing I like to do. I knew you can't do a straight conversion, but you could leverage a little bit of 3D, still get some of the interesting immersion that you have in a 3D world, but still playable with just a thumb. I settled on this RPG-ish interface. At the time, something we thought of doing, was "we have the Doom movie coming up out," and we were always kind of sad that we didn't have a PC or console title set up in time for the release, just because the development cycles were too out of skew to let that happen. But I realised that I could toss something together on the mobile phone in just a few months.

PC Gamer: Was making the mobile phone game fun?

John Carmack: Yeah, it was a lot of fun. In the PC space, we'd just got off the Doom development last year, which took four years of effort. For this I did a proof of concept in a couple of weekends of work, then I passed it on to Fountainhead Entertainment, which is my wife's company, and the total development time was just about four months. Looking back over things, that's about the same time it took for one of our very early shareware games. It was like stepping back in time ten or twelve years. Since I've gone through the development process I've really become a pretty big booster of the mobile platform for the possibility of doing slightly more creative things in the game design field.

The PC and console space is so risk averse because you're talking of millions upon millions of dollars in game budgets, and everything depends on a make or break decisions. When we look at something like this where it's done for tens of thousands of dollars, rather than tens of millions of dollars, you can afford to maybe pick up a different style, or a clever idea and give it a try.

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The other major benefit you get which we're lacking in the PC space is the rapid pace of evolution. You can build a project, get it out the door, learn your lessons from it, and go build something much better. The follow on project we've got going, a sort of fantasy RPG styled game in a similar engine; it's a much improved game. We were able to learn all the lessons from the playtesters, we were able to do apply them. I'm pretty excited about the possibilities.

PC Gamer: Where's id at the moment?

John Carmack: We had the Quake 4 getting out the door for the PC was a big thing, and all the 360 work is in submission with Microsoft right now. We should have Quake 4 ready for the Xbox 360 launch.

PC Gamer: Are you working on a new rendering engine?

John Carmack: Yeah. For the last year I've been working on new rendering technologies. It comes in fits and starts. Our internal project is not publicly announced on there. We're doing simultaneous development on Xbox 360, PC, and we intend to release on PS3 simultaneously as well, but it's not a mature enough platform right now for us to be doing much work on.

PC Gamer: Game engines have their own certain look to them. Quake 3 era games all have a similar lighting and texture model, so do Doom 3 era games, from the high-poly bump maps. Can you predict what the engine is going to look like from the start?

John Carmack: Usually when I set out making the technical decisions I don't know how it's going to turn out. A lot of it is working out what works, and what ideas come to you. It is worthwhile mentioning, as you said, that there's a characteristic look to the new engine, and it's going to be centred around Unique Texturing.

This is an argument I get into with people year after year. Every generation, someone comes up and says something like "procedural and synthetic textures and geometry are going to be the hot new thing". I've heard it for the last three console generations - it's not been true and it's never going to be true this generation too. It's because management of massive data-sets is always the better thing to do. That's what a lot of the

technologies we are working on centre around - both the management for the real time use of it, and the management of the efficient content creation side of it. I think that's going to give a dramatically better look than what we're seeing in this generation.

PC Gamer: Can you describe how it will look, in a layperson term.

John Carmack: When you start seeing screenshots of games designed like this, it'll be obvious that they're of a new generation. I'm not sure how much it comes through, but Quake Wars: Enemy Territory, the game Splash Damage are working on, that uses an intermediate half-way technique, the Megatexture stuff I did originally. They've really gone and run with that. Some of their screenshots are really starting to show the promise of unique texturing on everything. We've got an interesting combination of techniques on that - they did a procedural offline synthetic synthesis to generate the basis of the terrain, and I built some technology to let artists dynamically stamp things into all the channels in game. We're starting to see some really, really spectacular results out of this, as everyone climbs up the skill curve of using these new tools. The technology we're working on here at id takes that a step further with a terrain texturing system is applied throughout for everything.

PC Gamer: I have a quote here from Gabe Newell talking about the next generation of processors and consoles. He says "the problems of getting things running on multicore processors are not solved. We have doctoral theses but no real world applications." Do you agree with him?

John Carmack: The difference between theoretical performance and real world performance on the CPU level is growing fast. On say, a regular Xbox, you can get very large fractions of theoretical performance with not a whole lot of effort. The Playstation 2 was always a mess with the multiple processors on there, but the new generations, with Cell or the Xbox 360 make it much, much worse. They can quote these incredibly high numbers of giga-flop or tera-flops or whatever, but in reality, when you do a straighforward development process on them, they're significantly slower than a modern high end PC. It's only by doing significant architectural work that you even have a chance of finding speed-ups to what the PC can do, let alone it's theoretical performance. It's only through trivial, toy or contrived applications that you can deliver the performance

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numbers they claim.

The graphics systems are much better than though. Graphics has an inherent natural parallelism. The capabilities of the Xbox 360 and PS3 are really good on the graphics side, although, not any head or shoulders above any PC stuff that you can buy at a higher price point.

PC Gamer: When you create a technology, do you build features specifically for a game, or is a case you just testing to see what the silicon can do?

John Carmack: It's somewhere in between. You don't build technology for technology's sake. The people who would just build 3D engines without a game attached, those have never been the really successful products. In any case of engineering, you really need to tailor your design to what you're trying to accomplish. There are always the types of situations when you can say, "we know we want our game to have this type of outdoor stuff, or this type of indoor stuff," and you start trying to write technology for it, but you find out something might be harder than you expected, or you might get a novel idea, and that might feed back into the game design. We commonly switch gears during our development process when a really good opportunity comes up. We're not going to be pig-headed about something, and say "this is what our design spec says, so this is what we're going to do". We'll pick targets of opportunity when we get them, but the technology does very much try to build around what we want to accomplish with our games.

PC Gamer: Was there one of these "targets of opportunity" in the development of Doom 3?

John Carmack: When we left Quake 3 I had several different directions of technology that I considered potentially useful for next generation game engines. One of those was uniquely texturing the surfaces, and one of them was this bump-mapped and unified lighting thing that wound up in Doom. The decision I made at the time was that something that made less quality screenshots but a more dynamic environment would make a better game, which is why I took that direction, but it's interesting, now that the technology of the hardware has progressed, I can combine both of what I wanted to do with the unique texturing and the fully dynamic environments.

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PC Gamer: Do you ever miss shareware?

John Carmack: I think that the mobile business is giving me some of the vibe I had missed from the old days. I am really getting some enjoyment from working on that. Now, Fountainhead is doing most of the work on the titles, but it's been a situation for me where I can go in, do some core pieces of technology, provide some core design guidance out of that. I'll spend one day a week managing that project. It's kind of fun - the way that I built both major pieces of technology for this, I would go on a vacation with my wife, baby, and laptop and sit there and write technology while they went off and did something. When I got back to id, we could take that and work on it. That's been fun. There's a lot of potential with it. Shareware blew off and took id to a very influential position. The mobile game market it similar - it's an interesting game design space, an interesting technology space, and it may very well be an interesting market space.

PC Gamer: Is the Xbox 360 id's primary development platform?

John Carmack: [pause] It probably will be. As it is right now we would get the game up on the 360. When I would do major hack and slash architectural changes it was back on the PC, but it's looking like the Xbox 360 will be our target. All of our tools are on the PC, and we're maintaining the game running on the PC, but probably all of our gameplay development and testing will be done on the Xbox 360. It's a really sweet development system.

PC Gamer: At an event recently, your colleague Tim Willits said that id were seriously hurt by piracy. Has that influenced your decision to move to Xbox?

John Carmack: The PC market in general is getting really, really torched. Todd mentioned a statistic: last year was half the gross revenue of three years ago. A really grim number. People in the PC space are looking at games that, one way or another, require subscription or internet connection.

PC Gamer: Does moving to the Xbox change any of your open source support? You've been practically deified in that community for the way you allow them to work on your game engines.

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John Carmack: It makes it less of a priority to structure things in a way that they can be easily modified. But I think, already in the PC space, there's been a downswing in the modding scene. As projects got more and more complex the modifications that have gone on in the user community have got sparser and sparser because the teams have had to conglomerate into these super-groups to put something together. I think, looking back, Quake was the golden age of user-modifications. It was still crude enough that you didn't need an art director to produce a significant mod. That's saddening, but just the way the platforms have evolved.

Our PC version will probably continue, for ever after, to have significant modification capability. We'll release large chunks of source code for people to hack up any way they want. I intend to continue my practice of releasing complete engine source code sometime after the next major game is released. One year after our next game is out, I may very well be releasing the Doom 3 source code.

Chapter 19

MegaTexture Q&A

This interview was conducted by Cain Dornan for Gamer Within on May 01, 2006.

Interview

Prologue

One of the most respected and well-known game developers in the world, John Carmack hardly needs any introduction. Having mastered the skill of game programming, Carmack co-founded developer id Software, and has also worked on such classic series as Doom, Quake and Wolfenstein 3D.

In this Question & Answer with Carmack, he discusses the new MegaTexture technology, which will be used in the upcoming Enemy Territory: Quake Wars for PC. Definitely a worthy read for any programming, designing or general development enthusiast, as well as any gamer slightly interested in the development process behind games.

Questions

Cain Dornan: What is MegaTexturing technology?

John Carmack: MegaTexture technology is something that addresses re-source limitations in one particular aspect of graphics. The core idea of it is that when you start looking at outdoor rendering and how you want to do terrain and things in general, people almost always wind up with some kind of cross-fade blended approach where you tile your textures over and blend between them and add little bits of detail here and there. A really important thing to realize about just generally tiling textures, that we're so used to accepting it in games, is that when you have one repeated pattern over a bunch of geometry, the texture tiling and repeating is really just a very, very specialized form of data compression where it's allowing you to take a smaller amount of data and have it replicated over multiple surfaces, or multiple parts of the same surface in a game since you gen-erally don't have enough memory to be able to have the exact texture that you'd like everywhere.

The key point of that is what you really want to do is to be able to have as much texture as you want to use where you have something unique everywhere. Now normally, you just can't get away with doing that, be-cause if you allocate a 32,000 by 32,000 texture, the graphics curve can't render directly from that. There's not enough memory in the system to do that, and even when you have normal sized textures, games are always up against the limits of the graphics card memory, and system memory, and eventually you've got hard drive or DVD memory on there, but you wind up with a lot of different swapping schemes, where you'll have a lit-tle low-res version of a texture, and then high res versions that you bring in at different times, and a lot of effort goes into trying to manage this one way or the other.

So when Splash Damage was starting on, really early with Enemy Ter-ritory: QUAKE Wars, they were looking at some of these different ways to render the outdoor scenes with different blends and things like that. And one of my early suggestions to them was that they consider looking at an approach where you just use one monumentally large texture, and that turned out to be 32,000 by 32,000. And I - rather then doing it by

the conventional way that you would approach something like this (i.e. - chopping up the geometry into different pieces and mapping different textures on to there and incrementally swapping them for low res versus high res versions), just let them treat one uniform geometry mesh and have this effectively unbounded texture side on there, and use a more complicated fragment program to go ahead and pick out exactly what should be on there, just as if the graphics hardware and the system really did support such a huge texture.

In the end what this winds up getting us is the ability to create a great outdoor terrain texture that has far more complex interactions than anything that you would get with any kind of conventional rendering, where you've built it up out of pieces of lots of smaller textures on there, where they do some sophisticated things with growing grass up between bump maps. And then you can go back and do hand touch ups in a lot of different places to accent around features that are coming out of the surface. And this type of thing is, I'm very sure, going to become critically importance as we go forward into kind of next generation technologies on there. We've seen this over and over as we've gone through graphical technology improvements over the years, where there will be certain key elements that you start looking at in games that look really dated because they don't have the capabilities that people are seeing in sort of the cutting edge things there. And this type of unique texturing over the coming generation of games, I think, is going to be one of those, where when people start looking back at a game that's predominantly tiled and doesn't have that unique artist touched sense about all of the scenes, it's going to look very previous generation.

Cain Dornan: What's the benefit on the top most level just for gamers, of the MegaTexture. And the second part of that is what's the benefit as the developer?

John Carmack: Well for the user the bottom line is just that it looks better. You wind up with something that has the diversity that you don't get with more conventional terrain generation systems out there. As the developer, looks are still important for games. If you look at a game and you make it look better, it's a better game, so long as you don't impact the gameplay negatively. So it's nothing profound and fundamental, it's just one tiny little aspect of graphics rendering that's just better now.

Cain Dornan: Aside from the visual aspect of the terrain looking better, do you think there will be any other foreseeable differences to us gamers that are playing MegaTexture games?

John Carmack: It's just the variety and the diversity of it. Like I said at the very beginning, this is only a very small aspect of graphics, let alone of games in the larger sense. It's a specific little piece of technology that addresses texture resource limitations, and this entire technology would not need to exist if you had four gigabyte graphics cards, and lots more RAM. In fact, so much of programming and graphics programming in particular is just trying to pretend that we've got hardware that's five or 10 years more advanced than what we've got right now by making various algorithmic trade offs.

Cain Dornan: How is the MegaTexture a major step forward for game graphics?

John Carmack: My core comment here is that any repeating use of a texture is just very specialized data compression. Any time you have one set of texture data, and it's present in more than one place on the screen, it's really an approximation to what an ideal infinite resource video game would provide. Because in the real world, there aren't any repeats-even things that look like they repeat, like bricks or dry wall, are uniquely different. The subtle differences that you get are the things that distinguish a rendering, especially a game rendering, from something that's very realistic.

The MegaTexture allows us to have terrain in QUAKE Wars that does not require any repeated textures for resource limitation reasons. There may still be some areas where a texture is repeated just because they didn't feel like doing anything better, but there was no resource limitation that encouraged them or required them to do that. They are perfectly capable of having an artist go in and add 10 million little tiny touches to the level if they chose to do so. It's taken it from being a resource constraint to something that becomes a design trade off.

Cain Dornan: Does MegaTexturing technology bring any specific limitations with it?

John Carmack: No. There's no limit to dynamically changing it. That's

one of the neat things about it - to the graphics engine, it looks like you're just texturing on top of arbitrary geometry. You can move it around and all of that. With the technology in Enemy Territory: QUAKE Wars, there are some issues with deforming the texture coordinates too much. You'll get areas that are blurred more than you would expect with a conventional texturing, and that's something that's fixed in my newer rev of technology.

There are some minor things you have to worry a little bit about. If you stretched up too steep a cliff slide, there would be some blurring involved there, even if you adjusted the texture coordinate somewhat. And you can crutch around that a little bit. That's also a problem that's been fixed by a newer rev of technology that we've got right now.

Cain Dornan: So would you consider the fact that the MegaTexture paints all of the terrain with one enormous texture an advantage to level of detail or a limitation?

John Carmack: Level of detail wise, the terrain does not render with any sophisticated geometry morphing situation. That's one of those things that for years I think most of the research that's gone into has been wasted. Geometry level of detail on terrain.. there have been thousands of papers written about it, and I honestly don't think it's all that important. The way the hardware works, you're so much better off setting down a static mesh that's all in vertex and index buffers, and just letting the hardware plow through it, rather than going through and having the CPU attempt to do some really clever cross blended interpolation of vertices.

In and infinite sized world, you would have to include some degree of level of detail. The Quake Wars levels are not infinite size. They're bounded. And it generally turns out to be the best idea to just have the geometry at a reasonable level of detail and very efficiently rendered.

But the MegaTexture would work just fine if you wanted to use that on something where you were dynamically level detailing the terrain. That is one of the nice aspects of it, where to the application it just looks like you can texture with an infinite size texture. You don't have to worry about breaking it up on particular boundaries of anything special like that.

Cain Dornan: How do you see the mega texture developing in the next

few years?

John Carmack: The particular version that's in the Splash Damage code is essentially already abandoned, where the newer version of the stuff that I've got is a super setup that allows us to use it for arbitrary textures and has a few other nice benefits. It was one of those things where, if I had thought about it at the beginning, then I probably would have done it back then.

But from a technology development standpoint, content wise, the technologies that Splash Damage developed for creating these terrains ,and some of the stuff that I was working on to modify MegaTextures artistically, those are the corner stones of what we're using going forward for content creation.

Cain Dornan: Do you think that since it's a solution that's working with Enemy Territory: QUAKE Wars, it's eventually going to be used in other software.

John Carmack: Correct. What's exciting is that I did this stuff a long time ago, when I first did the initial MegaTexture stuff for Splash Damage, which is specialized for terrains. The MegaTexture works for things that are topologically a deformed plain, like an outdoor surface, and it has certain particular limitations on how much you can deform the texture mapping there. For the better part of a year after that initial creation, I have been sort of struggling to find a way to have a similar technology that creates this unique mapping of everything, and use it in a more general sense so that we could have it on architectural models, and arbitrary characters, and things like that.

Finally, I found a solution that lets us do everything that we want in a more general sense, which is what we're using in our current title that's under development. That was one of those really happy programmer moments, where I knew that this sense of unique texturing was a really positive step forward for what we could do artistically with the game. I just hadn't hit on the right thing for a long time, and then, finally, when I did settle down and come up with a technology that works for all of that, it was a good moment.

Cain Dornan: Do you think it is inevitable that this would be a wheel that

the other guys are going to have to reinvent, too?

John Carmack: Yes. Although most graphics rendering stuff is not that incredibly mysterious and difficult. It used to be that people were always looking for the black magic in the code, some place, but it's not that big of a deal. And especially now there are hundreds and hundreds of graphics programmers out there who, as soon as they see this type of stuff and read and article about it, they can go out and start implementing some of the same things. I expect that pretty much will happen.

I would say that the greater differentiation will be in the two ((inaudible)) that go into allowing people to take effective use of this because the core technology to do this is tiny. There's one file of source code that manages the individual blocks, and then the fragment program stuff for this is like a page. It's not that big of a deal. It's an architectural and mind set change that you have to make to decide to actually build a project that's going to leverage this type of technology.

Cain Dornan: Why do you think other developers haven't done anything like this before?

John Carmack: One aspect of it is certainly the fear of unboundaried development time. That's something that you can look at and say, "Oh my gosh, we make this many megabytes of textures. If we uniquely texture the entire world, it's going to be 50 times that. How are we going to get that done?" Generally that's a bad way to look at things, because while you now have the ability to uniquely texture everything, nothing is forcing you to. You can still set up and use the technology just like any old system where you repeat pictures; it's just that now you have the ability to do it everywhere you want to, anywhere your fancies strike you or your artist wants to go in and touch everything up to make an area look better. But, the worry about development time certainly is an issue and has been an issue for many years now. Specifically a significant concern about the fact that it's not such a good idea to develop a technology that is only going to make a game finish later and later. Anything that you're going to include that allows more capabilities will take longer to optimize. There are very, very few things that you can do that just automatically take the same effort, but produce something drastically better.

Cain Dornan: Did you create the MegaTexture technology with PC hard-

ware in mind? Or were you also planning for next gen consoles when you started coming up with it?

John Carmack: It was done on the PC. But we know that next-gen consoles are essentially PC graphics renderers.

Cain Dornan: Would the consoles having less memory than a PC pose a problem for the MegaTexture? Or is something that you guys have already started to work around?

John Carmack: If anything, it works out better for the next-generation consoles, because on the PC you could often get away with not doing texture management if you were targeting fairly high end, while on the consoles, you've always had to do it. And especially my newer paged virtual texturing which applies to everything instead of just terrain, allows you to have a uniform management of all texture resources there, as well as allowing infinitely sized texture dimensions. So this is actually working out very nicely on the Xbox 360.

Cain Dornan: Do you think the MegaTexture is a technology that will push hardware forward, in terms of gamers having to buy new upgrades for PCs, or not?

John Carmack: Interestingly, this isn't as performance demanding as a lot of things we've done before. While the exact implementation that I've done for ETQW wouldn't have been possible until the modern generation of cards, the fundamental idea of unique texturing is something that could have been done at any point all the way back to the 3DFX cards. And when I was originally starting the DOOM development five to six years ago, unique texturing was something that I looked at as a viable direction to go to make a next-generation step, but I instead chose to go with the bump mapping and the dynamic lighting and shadowing because I thought, for game play reasons, that they were going to work out better. It's a technology that I'm surprised that no one else wound up pursuing, because I picked my direction way back in the DOOM 3 days and I kind of saw this other viable path that people could be pursuing. I was kind of surprised that five, six, years later, nobody else had really taken that task, because it always looked good to me.

Cain Dornan: Do you think that the MegaTexture technology will be ac-

cessible to mod teams? I'm making the connection there in terms of thinking of some of the smaller teams out there.

John Carmack: It doesn't help them. In general, all the technology progress has been essentially reducing the ability of a mod team to do something significant and competitive. We've certainly seen this over the last 10 years, where, in the early days of somebody messing with DOOM or QUAKE, you could take essentially a pure concept idea, put it in, and see how the game play evolved there. But doing a mod now, if you're making new models, new animation, you essentially need to be a game studio doing something for free to do something that's going to be the significant equivalent. And almost nobody even considers doing a total conversion anymore. Anything like this that allows more media effort to be spent, probably does not help the mods.

Cain Dornan: Has the MegaTexture been a really rewarding breakthrough for you in the scope of some of your other accomplishments?

John Carmack: It's hard to put everything in comparison against all the different things I've done. Certainly in this generation of technologies that I'm working on I've done dozens and dozens of little experiments with lots of different graphics technologies. I do think that the unique texturing technologies are the most important of all of the things that I've done and are going to have the most significant impact.

There's a ton of little graphics technologies that you can experiment with, different rendering technologies, and ways of drawing things with silhouette lighting or deformation maps - just all sorts of things that are interesting when you look at them in a particular light, and may have some great use in a game. But any texturing technology is something that applies to everything, and I've always wanted to do technologies that have a more general application, rather than things that I always considered artifact effects that you put on a particular object. I'm probably more accepting of eye candy like that on particular objects now than I used to be, because people do find things like that catchy, and it will make an impact on people when they see something special. But I've generally preferred to set up technologies that effect everything uniformly across the entire game world and this is one of those.

Cain Dornan: Public perception of you is sometimes centered around

your love of technology in making games, and maybe more so for right or wrong, than the finished product. What do you think of that assessment?

John Carmack: Well, the gameplay really is intertwined with the presentation. I've never pursued a technology that I thought would negatively impact gameplay. It's always in the context of "how will this technology improve the game?" And it is true that I'm not the final arbiter of what's necessarily going to make our games fun, gameplay-wise. I don't necessarily consider myself representative of our target market. And the game play decisions are generally now made by Tim.

But I do still care about making sure that the technology that I help provide, which is sort of the canvas that everything is painted on, is something that will only have positive improvements to the whole game play experience. So I am focused more and more narrowly now, than I used to be, on the graphics technology and my little aspect of this. It's true that I used to write essentially all of the code for everything. But as the demands of the technology have improved we have to have more and more people and it gets more and more specialized. So I've sort of retrenched into the area where I have the most to offer and I put in the time that I can to it.

Cain Dornan: Is there anything else that you'd like to add?

John Carmack: It's still very exciting the capabilities that are continuously being added to our arsenal here. I am having a really good time working on the Xbox 360 right now, graphic technology-wise. As for the MegaTexture stuff, it is kind of funny that it's not super demanding of the hardware. As I mentioned, I was kind of surprised that something like this hadn't been pushed before we got around to it. There are lots more exciting possibilities for the graphics research and we're still toying around with some fairly fundamental architectural design issues on the Xbox 360.

And, the PC space is going to be moving even faster than the consoles. The graphics technology is still exciting and they're still going to be significant things that we can show to people that will make them look at this and say "wow, this is a lot better than the previous generation." I do think unique texturing is the key for the coming generation.

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There are lots and lots of graphics technologies that we can look at. And maybe you add five or six up and they wind up being something that really gives it a next generation wow. But just by itself, even with no newer presentation technologies, allowing unique texturing on lots and lots of surfaces, I think, is the key enabler for this generation.

CHAPTER 19. MEGATEXTURE Q&A

Chapter 20

CES 2007: John Carmack And Todd Hollenshead Speak

This interview was conducted by Billy Berghammer for Game Informer on Jan 09, 2007.

Interview

Prologue

Game Informer met with id Software's John Carmack and Todd Hollenshead to talk about, well, a lot of things. In our hour-long talk, we talked about the state of PC gaming, QuakeCon and the pros and cons of developing for the PlayStation 3 and Xbox 360. We've split the interview into two digestible chunks. Part one appears here today, and we'll run the conclusion tomorrow. Enjoy.

Questions

20.1 Part One

Billy Berghammer: First off, I just want to say congratulations on the awards. [John Carmack was just presented with a Technology Emmy award at CES for his work in 3D game engines, and id Software earned an Emmy for the company's rendering work.]

John Carmack: It still seems kind of a bizarre thing. I mean, whenever you hear Emmys and Oscars and stuff, you think high fashion and Hollywood, and that is so not what I'm about at all. And being honored with that - it's certainly one of the big-time honors that you're not going to turn down or are not going to step away from - but I never would have expected to receive something like this.

Billy Berghammer: After Enemy Territories: Quake Wars ships with the highly modified Doom 3 engine and the MegaTexture support, is it time for you guys to move on from that engine?

John Carmack: Yes, the in-house development project that we've been working on is all new technology. It still has some roots in the Doom 3 technology, but almost everything is new in there. We're still not talking about exactly what the project is, but it's a new IP, it's diverting a little bit from the standard id formula and it's not just a first-person shooter. Technically, it's built around an advancement over the MegaTexture technology from Quake Wars. Where that was applied just to the terrain, the version of the new technology applies it into everything, so we can have that level of rich detail on all the surfaces on the entire world. That's the push that we're making with graphics technology. The gameplay is somewhat different from anything that we've of done before. The company is pursuing Wolfenstein, Doom and Quake franchises with other partner developers and all, but we're trying to develop a brand-new franchise with this new one. Hopefully, we'll be talking about that sometime this year, and we'll be able to go ahead and come out of our own little cone of silence about it.

Billy Berghammer: Do you think that'll be at E3 or maybe the next Quake-

Con

John Carmack: I would certainly expect by the next QuakeCon, but...when is E3 this year?

Billy Berghammer: July

John Carmack: [pauses] I don't know. That's a toss-up. It kind of depends on what the business relationships and stuff are at that point.

Billy Berghammer: Are you planning on adopting DX10 for Quake Wars?

John Carmack: Not for Quake Wars, for sure. It has come up as a question for our internal development projects, and we weren't even expecting to ask that question. There's no massive pull for me for DX10. It would be more a question of if we don't think we're going to get done until Vista is broadly adopted, it might just save us development and support things to say it's a DX10 game - but there's no huge thing where we're dying to use any particular DX10 feature. It would just more be a question about practically, is the market there where we can write off everything else? Quake Wars is definitely not DX10.

Billy Berghammer: Since you're moving ahead with the new technology within the Doom 3 engine, you're not worried about adopting that for DX10?

John Carmack: No, because the DX9 stuff - actually, DX9 is really quite a good API [application programming interface] level. Even with the D3D [Direct3D] side of things, where I know I have a long history of people thinking I'm antagonistic against it. Microsoft has done a very, very good job of sensibly evolving it at each step - they're not worried about breaking backwards compatibility - and it's a pretty clean API. I especially like the work I'm doing on the 360, and it's probably the best graphics API as far as a sensibly designed thing that I've worked with.

Billy Berghammer: A lot of gamers are in the boat right now - and I'm in the boat as well - where they're saving money to buy a new rig. I was at QuakeCon two years ago with my computer, and I was just slow. So I've been saving cash to buy a new rig to handle the next-gen of PC games. Quake Wars, Spore and Crysis are all coming out on the horizon, and there's a big push for PC games this year. Do you think gamers should

take the plunge now for DX10, or do you think they should wait and stick with DX9.

John Carmack: I don't think that there's any huge need for people to jump right now. All the high-end video cards right now - video cards across the board - are great nowadays. This is not like it was years ago, where they'd say, "This one's poison, stay away from this. You really need to go for this." Both ATI and Nvidia are going a great job on the high end. Internally, we're still using more Nvidia cards, but it's not necessarily because we've done a careful analysis and we decided that they're superior in some way. They have better OpenGL support, but they're all good cards right now. Personally, I wouldn't jump at something like DX10 right now. I would let things settle out a little bit and wait until there's a really strong need for it. I doubt there's going to be any radical, obvious sweet spot where it's like, "Now is the time to go get things." It's fairly mature, the pace that things are going on, and I don't expect there's going to be any huge sea changes in the way things are moving.

Billy Berghammer: Is there anything in particular that you'd suggest if someone was going to be going out and buying a new computer right now that they should make sure they get in their new rig?

John Carmack: You know, not really. I think that while there are still points of differentiation between the different qualities of things both in graphics and processor and all that, it's hard to go wrong nowadays. The prices are so low relative to where things used to be and the performance is great. People can still screw up and buy a computer with no expandability or get stuck with some integrated graphics card on the motherboard or things like that, but it's been a long time since we've cared enough about the exact performance stuff to go and make exhaustive benchmarks on all the different things that we've done. I mean, the latest Intel processors are really fast, and we do find them pretty much top of the line. Jan Paul has done a lot of benchmarking for various compression and decompression things, and it is kind of neat going around benchmarking on the 360 and the different Intel processors and comparing everything, and Intel's done a really great job with the latest generation of things. It's funny from my position, but I'm not all that deeply into the latest and greatest nitty-gritty details between the different things on there. Maybe with the length of perspective that I've had, it's not all that

incredibly important - especially when we're looking at a four-year game-development title again. If I go and say, "Right now, this is absolutely the best thing, two years from now it's not going to matter." If I ever see anything where I think someone could make a really tragic mistake, like there was something out there that probably wouldn't be a good thing to buy into, I would warn people off.

Billy Berghammer: What's your take on Microsoft's attempt to make Vista a more viable gaming platform?

John Carmack: Microsoft has done a spectacular job on the 360 support. The PC, though, is fundamentally pretty different - with a variety of platforms and everything - and I don't think Microsoft's gaming initiatives...they're able to really show their stuff on the 360 and make great value there. So obviously, we like the PC as a game-development platform and it's still probably our favorite platform, but there are certain things I find more fun to do on the 360. We still very much like the PC, and most of that is due to Microsoft's general support of making it reasonable to do that there. I've never been a big believer in cross-platform games, because there are too many compromises you need to make to design the game to be the same game play on both of them and have co-op play across them and all that. So, that's not a major direction for me. Some of the tools that they wind up producing aren't things that we adopt, but they are things that are important to some studios. So, I wouldn't say Microsoft's latest gaming initiatives on Vista have had a significant impact on id Software - and they might not even be the best use of Microsoft's various resources - but they have so many resources they kind of scatter them around, and it's not a horrible thing to do.

Billy Berghammer: What do you think about them trying to bring the Xbox Live platform to the PC space?

John Carmack: Well, that's been one of Microsoft's big successes. They really did wind up hitting on a good set of things with Xbox Live. They probably surprised Sony with how a lot of the things are working out there, and we'll probably wind up utilizing some of their technology on the PC space. People are expecting such richer and richer experiences with all of that now, where it's becoming burdensome to continue to re-develop all of that sort of stuff, and the platform is possibly standardiz-

ing. It seems people are generally pretty happy with what they get with Live, and I don't think it would be too big of a shame to make that sort of a standard interface across the board for the PC as well.

Billy Berghammer: Can you see them charging, like they do for Xbox Live, or do you think those are waters you don't want to dip your toes into?

John Carmack: I really haven't even given it that much consideration. I think that they are providing a decent service for that. We're very happy with our live downloads and stuff like that, and there's value there, but I would expect that Microsoft would end up subsidizing that for their platform, but I don't really know.

Todd Hollenshead: Didn't AOL try that with a closed-content network that they charged a premium price for, and then ended up making it all free? That would be my kneejerk reaction. I think for games like Quake 3 or the multiplayer aspects of first-person games and those sorts of things, it's going to be a hard sell to players who have had it free for over a decade now and now they're going to be charged for it. If it's a persistent type of game or a more persistent type of game...you know some of the things that we're talking about like Enemy Territory: Quake Wars, where it still is an instanced game. You don't have levels or anything like that, but when you play you can actually - through experience points - get better abilities. But when you log off, your experience effectively goes away and you start again the next time you play at zero. Some of the sorts of things we have planned for the game is a persistence type of stat tracking, so that you can be on ladders and have skill points and these sorts of things that you really haven't seen that much on the PC outside the MMO-type games but that you see with all of the achievements and ladders and things on the XLA side.

Billy Berghammer: We've heard mixed results from developers on developing for, or bringing their games over to, Vista. Some have loved it, and others have been lukewarm about it. What are your thoughts on Vista?

John Carmack: We only have a couple of people running Vista at our company. It's again, one of those things that there is no strong pull for us to go there. If anything, it's going to be reluctantly like, "Well, a lot of the market is there, so we'll move to Vista." Other people that are running it

are going, "It's coming around, you've gotta run this. This is the greatest thing on here."

Todd Hollenshead: And it has posed some backwards-compatibility problems for us with Doom 3, Quake 4, Quake 3...

John Carmack: Quake 3 is a problem on it?

Todd Hollenshead: Well, it's not that it's a problem, but more of that we haven't done much testing with it.

John Carmack: I'm pretty sure (Quake) 1 through 3 work just fine.

Todd Hollenshead: But yeah, there has been some level of concentrations, at least on my part. It's like a whole new QA process. Publishers aren't really used to having to fund that on a title like Doom 3, which a still a very significant selling title. But it's one where Activision thought their support aspect of it was effectively dwindling down to zero. What we ended up doing right was basically doing it ourselves, because Activision didn't want to do it. We had to go through a whole QA process with Doom 3, so we had to pull people off of the various things that they're working on.

John Carmack: It's a tough thing for Microsoft, where, essentially, Windows XP was a just fine operating system. Before that, there were horrible problems with Windows. But once they got there, it did everything an operating system is supposed to do. Nothing is going to help a new game by going to a new operating system. There were some clear wins going from Windows 95 to Windows XP for games, but there really aren't any for Vista. They're artificially doing that by tying DX10 so close it, which is really nothing about the OS. It's a hardware-interface spec. It's an artificial thing that they're doing there. They're really grasping at straws for reasons to upgrade the operating system. I suspect I could run XP for a great many more years without having a problem with it.

Billy Berghammer: At QuakeCon two years ago, you were very adamant during your keynote about not being too thrilled about developing for multi-core systems. Not just specifically with PCs, but also the PlayStation 3 and Xbox 360. Now that you've been working with both of them since then, have your thoughts changed at all?

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SPEAK

John Carmack: Microsoft has made some pretty nice tools that show you what you can make on the Xbox 360. I get a nice multi-frame graph, and I can label everything across six threads and three cores. They are nice tools for doing all of that, but the fundamental problem is that it's still hard to do. If you want to utilize all of that unused performance, it's going to become more of a risk to you and bring pain and suffering to the programming side. It already tends to be a long pole in the tent for getting a game out of the door. It's no help to developers to be adding all of this extra stuff where we can spend more effort on this. We're going to be incentivized, obviously, to take advantage of the system, because everybody's going to be doing that. It's not like anyone's going to say that it's impossible to do. People tend to look at it from the up side. It gives you this many more flops and it gives you this much more power to do that. But you have to recognize that there is another edge to that sword, and you will suffer in some ways for dealing with this. I don't have any expectation that anytime soon, a massive breakthrough will occur that will make parallel programming much easier. It's been an active research project for many years. Better tools will help and somewhat better programming methodologies will help. One of the big problems with modern game development with C/C++ languages is that your junior programmer who's supposed to be over there working on how the pistol works can't have one tiny little erase condition that interacts with the background thread doing something. I do sweat about the fragility of what we do with the large-scale software stuff with multiple programmers developing on things, and adding multi-core development makes it much scarier and much worse in that regard.

So we're dealing with it, but it's an aspect of the landscape that obviously would have been better if we would have been able to get more gigahertz in a processor core. But life didn't turn out like that, and we have to just take the best advantage with it.

Billy Berghammer: You talked a lot about the Xbox 360. What are your thoughts on the PlayStation 3 now that you've had more time on it?

John Carmack: We've got our PlayStation 3 dev kits, and we've got our code compiling on it. I do intend to do a simultaneous release on it. But the honest truth is that Microsoft dev tools are so much better than Sony's. We expect to keep in mind the issues of bringing this up on the

PlayStation 3. But we're not going to do much until we're at the point where we need to bring it up to spec on the PlayStation 3. We'll probably do that two or three times during the major development schedule. It's not something we're going to try and keep in-step with us. None of my opinions have really changed on that. I think the decision to use an asymmetric CPU by Sony was a wrong one. There are aspects that could make it a winning decision, but they're not helpful to the developers. If they make the developers say that Sony is going to own the main marketplace, let's make them develop toward this and build it this way, it would somewhat downplay the benefits of the Xbox 360 and play to the PlayStation 3's strengths. I suspect they're not going to overwhelmingly crush the marketplace this time, which wasn't clear a year ago. A lot of people were thinking it's going to be a rerun of the last generation, and it's now looking like it might not be. I've been pulling for Microsoft, because I think they've done a better job for development support, and I think they have made somewhat smarter decisions on the platform. It's not like the PlayStation 3 is a piece of junk or anything. I was not a fan of the PlayStation 2 and the way its architecture was set up. With the PlayStation 3, it's not even that it's ugly - they just took a design decision that wasn't the best from a development standpoint.

Billy Berghammer: When you were talking about adding more resources into the parallel development, do you feel that goes against Microsoft's XNA platform? Microsoft's spiel was that you used to spend 80% on problems and 20% on creativity.

John Carmack: Yeah, that's all bullshit. If anything, when you give processing power in a way that is not convenient on here, it can make you spend more effort. It can make you do greater things like with physics or accelerate audio or something, but it's not like that you have this hardware that takes whatever work you were doing and makes it into less work. And this had analogs through all kinds of parallel processing on there. It's very rare that you have a piece of hardware that can make what you were doing easier. Usually, you have to spend more effort, but you get something vastly more powerful in the end. Even 3D graphics was kind of like that - especially a lot of the early cards. They were a decelerator, people used to joke. If you ran a game that had a really good software rasterizer, like Quake, and you chose to run that through most of the early

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3D cards, it actually got slower. But then you could say: "Oh, you can run at a higher resolution and you can get filtering." But it was still not making what you were doing go faster. So you had to go put in all of this other work to try and bring the speed back and also get these other advantages. The same type of thing was true with sound accelerators, and we still deal with EAX and stuff, but it's not a high-return platform. And people are dealing with that with the standalone physics accelerator. I don't think a physics accelerator alone will ever be a big thing. If anything, it will be technology rolled into something else.

So with all of the extra power, we're going to be able to do some cool things with it, but by no means will it make our lives easier. Now it will be more like, "Hey audio guy, you no longer have to live in 10%. This core is all you. Have a blast." That type of thing will make life easier, but it's not the most efficient use of resources.

20.2   Part Two

Billy Berghammer: We're talking about the high end. Going to the other side, you've gone back and programmed for simpler systems, like cell phones. On the console side, the Wii is the most underpowered, as they say. What do you think about developing for the Wii?

John Carmack: You know, we've never had a good relationship with Nintendo, from really early products we did a long time ago. And for the most part, we just said, "Fine." We're busy with other stuff, and we just haven't been that tight with Nintendo. On the up side, I really do respect what they're doing, where for years, I've been saying - you probably heard me at QuakeCon - I will go on about how IO devices are where the really big differences are going to be made in gaming. You can get ten times the graphics power, and you can make a prettier picture, but when somebody makes a new IO device that really changes the way that people interact with the game, that's going to have a larger benefit there. So I'm really pleased with what they're doing with the Wii and with the DS - and they're doing innovative things. But our current generation of game technology is not targeted at the Wii. Maybe that was a mistake on our part

originally, but we have been looking strictly at the 360, PS3 and PC as what we want to simultaneously develop on. We probably aren't going to be able to hit the Wii with the same technology platform.

Billy Berghammer: What are your thoughts on episodic gaming?

John Carmack: You know, it's one of those things that sounds like a good idea initially, but I'm not sure that - it'll probably have some degree of success - but I don't think it's necessarily a method that's going to cover the majority of the gaming market right now. I think it does tend to feel a little bit - it's all in market psychology and all of that, and I won't claim to be any kind of an expert on that there. It would be nice if games could be developed more piecemeal like that, but it still is so heavily front-loaded to build your basic core on there. It would be great if you could go ahead and release episodes regularly after that, but I think the customers feel to some degree that if they buy a game and they can get episodic additions to it, that there's this sense of, "Why didn't they just put that on there when I bought the main game itself?" I think there are some barriers to overcome. It would be nice when Internet distribution does become the main way that people get their games and you can just continue carrying out additional upgrades as long as you've got enough people willing to buy them. I think that would be good for game-development studios. But, so far, nothing's come along that really satisfies the same thing as the blockbuster commercial release. Of course, it's a tough market, with winners and losers, but even if you're in the winner's slot, that's still where the big successes are. But I do think it's possible for a lot of the less-conventional marketing strategies to get to a lot of game studios. There's probably a lot of good business there, but it's not the same thing as if you've got the possibility of doing a triple A title, there's nothing that's currently drawing you away from that.

Todd Hollenshead: If you're doing a triple A title, I think there are sub-stantive reasons as to why you would choose to go that direction. I mean, the first thing, as John said, is that the costs are front-loaded in terms of time and the expenses, and basically the game has to be done, especially from a programming standpoint, by the time you release the first episode. You can add some features as you go along, but the fundamental aspects of what you're going to be able to do from a significant level are going to have to be done. You incur all the time and expense to create

that, and typically the media creation is not something that's gating you for release anyway. So, there's a bit of out-of-sync between how you incur time and cost and how you would actually recoup that through sales. Plus, there's the way that the market is set up and the way consumer expectations are set, certainly, publishers' market games are for games with a large launch with maybe some potential upside. You saw a game like Battlefield: 1942 that had a big launch, but then when it caught on it still had a crescendo of support. Typically, the game-sales curve is that you have your biggest month in your launch month, and it decays from there as retailers devote less and less shelf space to it, publishers devote less and less marketing dollars to promoting it and those sorts of things. So, talking about a long-term cycle of continuing to have to support that from a retail channel of support and a marketing dollar channel of support - it's very difficult for the market to understand how exactly that's going to work.

Billy Berghammer: Obviously, the retail chain's going to hate it.

Todd Hollenshead: They're not going to like it, because you have effectively one product that gets split into, let's say, four boxes at lower price points, and that's the exact opposite direction that retail wants to be in. If you're talking about Internet distribution, there are issues there, but the main one is that even when you look at Half Life 2 and the episodic content, the biggest litmus test is taking a triple A title, where you have retail distribution and Internet distribution, and the choice that Valve made was to have both, which I think tells you that even with a company that's extremely motivated - because they have their own proprietary distribution system - to go exclusively with that distribution system understands that from a market reality standpoint that if you want the big dollars, you're going to have to be in retail stores, too, at this point in time.

John Carmack: That is one of the interesting things about the cell-phone market, where instead of the fall off on sales curves like with PC titles, the cell-phone ones actually tend to grow with time as word-of-mouth gets around. And it's an interesting different sales dynamic, and I do always hope for something that - it's sort of a shame, where with a cell phone, most of the content comes over the air, which has this weird dynamic with the fact that memories are getting huge on the cell phones and you have a little straw to suck the content through, and that has its own set

of issues. It has the potential there, where if people are always buying the games on there, where it should be this egalitarian system where you should be able to get any sort of content through there, but because of the way that it is tightly controlled by the providers on there - who are not exactly nimble, quick companies - and they have that aspect of that, dealing with the actual cell-phone companies does stink. It's interesting to play around with different distribution strategies and technologies on something like that where you're not talking about sinking thirty million dollars on development into something that you want to roll the dice on.

Billy Berghammer: Speaking of Valve, what's your take on Steam?

Todd Hollenshead: I think as far as an Internet-distribution methodology, that it's probably the most effective right now. They're not the only game in town anymore, there are competitors, and the issue for a developer like id is that if we use Steam then we have to bolt someone else's distribution system onto our technology as opposed to if you're a Source engine licensee or something, that all kind of comes pre-packaged. So, that would be an issue for us, but I think it's a pretty big advantage for Valve to be able to have a second line of publishing for their own titles.

John Carmack: Of course, it doesn't help developers that much, because they take as big of a cut as a conventional publisher would.

Todd Hollenshead: I've spoken to them about Steam and I've looked at it for our back catalog, and the royalty Valve was getting - and we have a publisher that still has distribution rights we'd have to share - and by the time we go through all of the royalties, you end up making less money distributing it over the Internet, which is the opposite of the way you think it should be. The story that Gabe [Newell] told at GDC, when he sort of introduced Steam as, "Here is your distribution platform of the future," and all that - I don't think Gabe intentionally misled anyone, but I was there, and I saw that there were serious flaws in the economic analysis that he laid out for developers. The problem for most developers is not one of not getting paid enough once the game is out, it's that they don't have the seed funding necessary to internally fund development of their titles. That's why they work for publishers on milestone schedules and advances against future royalties, and Steam offers no solution for that. It also doesn't offer any solution for the marketing spend ques-

tion, where if developers don't even have enough money to fund themselves internally to develop their product, then they're not going to be able to pay for a multimillion dollar marketing campaign, which is a huge amount of risk that as an industry standpoint is offloaded from developers to publishers. A lot of the marketing spending goes in advance. They have their metrics about what game anticipation is and game rankings and a number of measures that they can use to gauge their marketing spends. Building the inventory and spending the marketing dollars, those are before you get a dollar of revenue, generally, and developers just can't afford that, and Valve doesn't have a seed-capital solution for that. So the issue is that if developers are beholden to publishers, which gives publishers more leverage in the business relationship, the problem with using Steam is that it would only make sense for a developer like id or Epic or Valve, who are completely internally self-funded. We don't have that issue of not having leverage with publishers because we have to borrow their money to make our games or they have to pay us to make games for them. To me, that's a bit of the catch-22. I think when you look at the access to a market, in terms of, "Hey, we have this game and we want to make it available to everyone who has Steam," which is theoretically everyone who has bought Half Life a few years after it was out or Half Life 2 or a lot of these other titles, I think that they've created an asset that has significant value.

John Carmack: It's getting to be one of those things where in the long term it's obvious that you're going to be able to say, "I want to play this computer game," you just click here on your computer and you get it. There's no question that that is a powerful model that people are going to want to pursue, it's just a question of how it works out in the next decade.

Todd Hollenshead: Yeah, and you do see almost all of the publishers now are either working on their own internal solution or partnering with a retailer. There's this whole crazy deal where publishers feel like it's a bad idea to be in theoretical competition with their customers. Even though they have their own little Internet stores, they haven't gone at being direct to the customer. For a developer like us, that's never made any sense at all. If the market is more efficient to be more direct with your customer, then it seems to me that that's what you should strive for. They have been paranoid about telling a retailer, "We want to sell you X hun-

dred thousands of copies, and meanwhile we're going to be doing our best to make sure that no one buys one because we're selling them all through this sales-distribution avenue that you have no access to." What I think we're seeing is that EA is working with Valve and they're working on their own solution, and Activision is working on their own solution, and all the publishers we're talking to now, whether they've announced it or not, at least have some kind of plan - whether it's in partnership with retail through some online distribution or whether they're going to build something or license something - I think they all recognize that this is on the horizon. I think one of the worst business decisions that you can make is to fight an inevitable technology.

Billy Berghammer: This year's QuakeCon is coming up...

Todd Hollenshead: I don't know if I'm supposed to say this or not, but the Anatole [the Hilton Anatole Hotel in Dallas], that's where QuakeCon is going to be for the next two years. We've entered a two-year deal with them. Last year's QuakeCon, I think it ended up working out a whole lot better than I thought it was going to be, given the last-minute nature of the way things came together. The problem really was - and I think people always think there's some kind of big conspiracy or something or incompetence - but we got the rug jerked under our feet from the Gaylord Texan, where we'd had it the previous two years. They told us they had a date saved for us and then, lo and behold, surprise, it came through some alleged scheduling snafu the dates weren't going to work because they had someone coming in on a date that we absolutely had to have the space. I think we made the best out of an unpleasant situation, and it ended up being a lot of fun at the Anatole this year, and the guys there really appreciated the business. I don't think the Gaylord Texan ever appreciated the QuakeCon crowd, and I really don't like to apologize for our guys. We love the people who come out there, and they have their own thing. If you get 5,000 people together and expect that there are going to be no problems whatsoever, then you're not in touch with reality. The Gaylord wanted the Red Boa ladies or whatever. I just use that as an example because it seems whenever I'm at that hotel they're there. You know, it's like women in their 50s and 60s and 70s and they go out for a week to get away from, I don't know, their husbands, and they go out and party or go get as crazy as you can at that age. That's the crowd that

they wanted, which is different in lots of ways than the Quake crowd. I mean we advertise it as a party for the fans, and when you have college and that sort of demographic at an event, then you're going to have a certain amount of zest for life that maybe at 70 years old you're not going to appreciate.

John Carmack: But realistically, we don't have that many problems at QuakeCon. If it was a football convention or something, there would probably be a lot more incidents.

Billy Berghammer: I was there two years ago, and the later it got it got loud and I saw some crazy stuff, but I've seen worse at other places.

Todd Hollenshead: It kind of comes down to, and this is sort of a silly example, the hotel freaked out because somebody smoked pot in the hotel. And I'm like, "If you're freaking about somebody smoking pot in your hotel, then you haven't been in the hotel business very long or you freak out way too easy." What do you say? "I didn't tell them it was OK, but it's their room." It's like, "Yeah, well what else is new, and what do you want us to do about that?" It's not something that we endorse, but at the same time we realize that it's there. Our deal was that we police the convention center, and we did that. We told them that they needed to police the hotel, and they're coming to us with issues like that. That's on their side, and they needed to take care of those sorts of issues. This year's QuakeCon is August 2-5. The Anatole worked out great. Where we had the BYOC [bring your own computer] and the vendor area is now all BYOC, and the room beside that, where we had the stage presentations, is now all going to become the vendor area. We're changing the way it works, too. As opposed to having everybody who is a vendor being effectively a sponsor of the event, we're basically going to the E3 or GDC methodology of booth space. You'll get a space, like if it's ten by ten, it's $2,500 and it goes from there.

John Carmack: So we won't have someone from Intel bitching about having an AMD poster, and vice versa.

Todd Hollenshead: We do want to have certain aspects of the event sponsored, for example a tournament sponsor. You don't have to be an exhibitor to be a sponsor or vice versa. You can be one or the other or whatever it is that you want to do. We are making it more like - at least for

the exhibitors, vendors and sponsors - a traditional trade show. Part of it is with changes to E3, we see an opportunity to raise the profile of the event and also, as John said, we've had issues in the past where if Nvidia has a partnership with AMD and we have Intel as a sponsor then Intel gets upset with AMD logos in the Nvidia booth. There's gamesmanship that goes on amongst the sponsors, that if they didn't get the exclusive, then they're looking for a way to wedge in and get some display there. Then we get bitching from the other side, which is totally understandable. But it really does end up being like separating fighting siblings over things, and we'd rather not be babysitters about that stuff anymore.

Billy Berghammer: Are there any other plans for the event that you can share yet?

Todd Hollenshead: I think most of the stuff we've talked about in the press releases is sort of where we're going. QuakeCon is one of those things that when it gets to specifics, when we get more momentum on the event we actually plan that stuff. We'll have the tournaments again, and expect the BYOC to be massively expanded. There's an opportunity for the event to be the biggest that it's ever been, and that would certainly be our hope. It may be even bigger, in terms of attendance, than we had at Gaylord. That's going to be a challenge for us because, technically, it's a little less total square footage space. We really do like the Anatole, and they were totally cool to everybody who came. Like on the croquet court. I think there's a rule on it that says you can only wear white on it, but someone went to Wal-Mart and bought some of those giant-ass bouncy balls and then put numbers on them and they were playing human pool where you'd kick the ball and then put chairs on the side of the croquet court. The hotel was like, "OK, you can't have the chairs out there," because it's basically like a golfing green and they don't want the chairs tearing up the grass. Then they just had people out there spread their legs and if the ball went through, it formed a pocket. Stuff like that, they're just totally cool. There was a report of damage, which the hotel didn't freak out about, like an overhead lamp fixture got broken or something, and they came and said, "Well, we had this lamp that was broken because two people were out last night having a light-saber battle and they hit one."

Billy Berghammer: Two more quick questions. Is there any game or tech

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that you've seen in the past year that's made you say, "Wow"?

John Carmack: I think Gears of War looks great. I really do. I think they did an excellent job with that. They did a lot of things really well. That's the best-looking thing that I've seen in a while.

Todd Hollenshead: The Crysis stuff looks pretty good, too. I don't know if you've seen that.

John Carmack: Yeah, that's not a shipping product yet.

Billy Berghammer: Doom, starring the Rock. Any regrets?

John Carmack: It's obviously not an Oscar-worthy movie, but I had fun watching it. I saw it twice, and I thought it was pretty good. All I wanted it to be was not wretched. I didn't want it to be Super Mario Brothers or Double Dragon - the really, really bad movies. And it came out and did pretty well, and I thought it was pretty good. So, no regrets.

Todd Hollenshead: It was a tough thing, too, you know. The movie had been in some level of production across different license holders for years and years. Still, it was the first time we'd ever done anything like that, and a lot of the stuff was me working with people on stuff that I had absolutely no experience working on. I think you learn a lot in the process working on something like that. I think Hollywood is a bit voodooish and they keep very much, "Pay no attention to the man behind the curtain," about how things work, and I guess that's just sort of part of the mystique of it. Part of that is, "We're spending all this money to make it," and the studio takes the responsibility for, and takes control of as much responsibility, as they can get. I think we maybe let them have a little bit too much. There are some things that I would do a little differently, but I think the main thing is to get the people that really understand the game who are really interested in making the type of movie that is true to the game.

John Carmack: My only regret is that they didn't play up the satanic Hell aspect, that it just became a genetic mutation. I did want it to be more about evil, but I can understand why they cast it the way they did, and I think they did a decent job with it.

Billy Berghammer: Would you guys like to revisit Hollywood? Try it again?

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Todd Hollenshead: One of the things we're working on now, although the rights are currently all back with us, with Wolfenstein in development there's interest in a Wolfenstein movie. And Sony had the rights for a while and those recently expired and came back to us.

John Carmack: And I would hope that at least the same thing doesn't happen on there, where it doesn't get turned into a traditional war movie. You have to have that aspect of the macabre and the supernatural to make it into something other than Brothers in Arms or whatever.

Todd Hollenshead: It's kind of an interesting process. You don't want to stifle someone's creativity so they have to make a movie that's exactly the same thing as a video game, which I don't think results in very good movies. At the same time, you want to put parameters in place so that you can't do something that's completely not in line, which makes sense. If they wanted to make a World War II movie, why did they pay id a license for Wolfenstein unless it's just a way to monetize off the name. We try to put some criteria in to constrain them in some ways but allow them to be creative in others. If things work out right, in a lot of ways these things end up being totally dependant on the script and if you get a good script that works with the movie, if an actor reads it the director reads it and likes it, then you can get a good cast of talent together.

Billy Berghammer: Thanks for your time.

Chapter 21

QuakeCon 2007: John Carmack Talks Rage, id Tech 5 And More

This interview was conducted by Billy Berghammer for Game Informer on Aug 03, 2007.

Interview

Prologue

QuakeCon's big event is Friday night - John Carmack's keynote speech. We had the opportunity to catch up with things since our CES interview and get the important details about id Tech 5. Will it work with DX10? Wii? What is Rage? What's going on with Doom 4? What the heck is Quake Zero? Carmack spills the beans on the next Quake Arena project and a whole lot more in this extensive QuakeCon interview!

Questions

Billy Berghammer: When we interviewed you at CES this year, and Quake-Con two years ago you weren't too thrilled with developing for multicore systems. Obviously now, that's the case across all platforms. Were you kind of at the point with id Tech 5 where, you said, "We give in?"

John Carmack: You have to take advantage of what's on the table. Although it's interesting that almost all of the PS3 launch titles hardly used any Cells at all. We hired one of the best PS3 guys around who did the Edge Acceleration technology for Sony - he's on our team now so we've got some of the best PS3 experience here. In fact when we were doing all of the tech demos, we'd bring in the developers and they'd walk over and say, "it's running on the PS3!" (laughs) They'd sit there and stare at it for a while.

There's no doubt that with all of the platforms that we have running here PS3 is the most challenging to develop on. That's what I've been saying from the beginning. It's not that it was a boneheaded decision because they're a lot closer the fact that they can run like this [points to the 4 different gaming stations running Rage] - they're a lot closer than they've ever been before. It's a hell of a lot better than PS2 versus Xbox. But given the choice, we'd rather develop on the Xbox 360. The PS3 still does have in theory more power that could be extracted but it's not smart. We don't feel it's smart to head down that rat hole. In fact, the biggest thing we worry about right now is memory. Microsoft extracts 32 megs for their system stuff and Sony takes 96. That's a big deal because the PS3 is already partitioned memory where the 360 is 512 megs of unified and on the PS3 is 256 of video, 256 of memory minus 96 for their system...stuff. Stuff is not the first thing that came to my mind there. (laughs)

The PS3 is not the favorite platform but it's going to run the game just as good. To some degree there's going to be some lowest common denominator effect because we're going to be testing these every day on all of the platforms, and it's going to be "Dammit it's out of memory on the PS3 again, go crunch some things down" That's probably going to be the sore spot for all of this but because we're continuous builds on all of these we're going to be fighting these battles as we go rather than build these

things out and go, "Oh my God we're so far away from running on there." Which is the situation where Enemy Territory is suffering with at a degree right now, and a lot of other people have that.

Billy Berghammer: Will this engine support any DX10 features?

John Carmack: No, not currently. We're not expecting to. We're not sure if we're going to be a Vista title or not. There will be some support benefits by being Vista only. It depends when we get the game done what the adoption has been. But it's a OpenGL title on the PC and Mac right now, obviously D3D on the 360, and the PS3 it's kind of an in between where it's Open GLES but we do a lot of direct command buffer writing there. If necessary we can move the PC version over to DX10, but there's not much strong pull for us to do that. All of the toolset is in OpenGL, I wouldn't want to convert everything over.

Billy Berghammer: You didn't seem to hot on DX10 or Vista at CES.

John Carmack: Microsoft has done a great job with all this stuff. I mean, I honestly think that DX9 with how it's implemented on the 360 is a clearer and more open API than OpenGL is. It doesn't hide the state.

That's sort of the Microsoft way. They start off with a piece of crap, and then over a number of versions taking a lot of people with them over the painful route they eventually get to something that's better than what they are competing against. It's a valid strategic direction. I think they've come out at the end with a good platform and a good product. Some of the DX10 stuff I don't think there's going to be huge draws for the features there, but a lot of what they've done with the structuring of the API I think are still positive things to do there. I think they have a good team with solid engineering there.

Billy Berghammer: You've got all the platforms except one. Could someone theoretically use a light version of id Tech 5 to develop a Wii title?

John Carmack: We could port the Megatexture stuff over, we could port most of the engine over there, but you wouldn't be able to use the same set of original content. There's a bigger gap there. We don't have any major intention to port this entire technology platform to the Wii. What I am kind of hoping for is if Orcs and Elves is big on the DS I want to do

Orcs and Elves for the Wii. You know wave the wand in the air.(laughs) My whole reverse engineering for the platform. I still have high hopes for that. Start on mobile, go to the DS, go to the Wii. Then maybe wind up on the 360, PC.

I'm thrilled that Nintendo has had great success with the Wii because while Nintendo has never been my favorite company - relationships between id and Nintendo - we're not a good match in general. We match better with Microsoft with how they position the 360. But one of my tenants that's near and dear to my heart is the significant improvements that are going to be done are with IO devices and the Wii I think is a really good demonstration of that. They've taken something that's much less powerful but it has an innovative IO device. But the fact that they did something different it added a lot of value.

Billy Berghammer: Do you play [Wii] a lot?

John Carmack: Not a lot. I've got a Wii. My almost three-year-old boy, I got that out so we could wave things around there. I play a little bit but I don't play a huge amount of video games in general. No time.

Billy Berghammer: So why did you choose a Mac show to first debut id Tech 5 for the first time, and then show it all off at QuakeCon. I know you showed it to a few people at E3, but not the masses.

John Carmack: The Mac thing was just this weird happenstance. Macs have been sort of infiltrating our office. They've been sprouting up a lot and people are getting Macbooks and they're generally pretty well regarded. Robert Duffy who's the programming lead has four Mac's or something. He was like, "I'm going to port Rage over to the Mac." Okay, that's a good thing. We learn something every time we move over to a new platform. It was always a good idea there. As it was going over we had a meeting with Apple and they said, "What about doing some of this for Steve's keynote." I've had ups and downs with the whole relationship with Apple and Steve, but we thought it was probably a decent thing to do because it was going to be the first crunch point for the team. It's a good team building exercise. The time where you get everyone there working at 2am trying to get things done. In the large scheme Mac Worldwide Developers Conference isn't the hugely important thing to do. It was a good point to see what we could do, because we knew at that time we were

already aiming to be showing at E3. So then we were like, "Can we limit features a bit and show something a month before E3?" We figured it was a reasonable thing to do and in hindsight it was a worthwhile technology path to take.

The E3 stuff was all developer only. We still hadn't announced Rage. I think we were actually waiting to see if we were trademark cleared at E3. Trademarking game names is a far bigger deal than most people give it credit. It's amazingly frustrating. You can have a page of names and then have them come back and say none of those are okay.

The old story was that Quake II which has nothing to do with Quake I was going to be a completely different name, but we got fed up with getting the names rejected so we said, "Dammit, it's Quake II. We own that trademark."

Billy Berghammer: What can you say about Rage? When everyone saw the shakey-cam footage people were wondering if you were making a racing game....

John Carmack: It's about 50/50 racing and first person action. It's interesting. If we go back post Doom 3, we started making a completely different game. It's internal name was The Darkness, which it's obvious that someone else has taken since then (laughs) but it was going to be another spooky dark survival horror thing set on an island. We spent a lot of time going on that. But we reached this point where, "Do we really need to do another dark, spooky game?" id always gets slammed for the game is always too dark. Maybe we should do another game that's a little brighter. We can branch out a bit more. Maybe it would be more fun to run over people with pick up trucks and ATVs. We rebooted our entire development project. We were reasonably far into production on The Darkness title and we just said we wanted to go in a completely different direction. We wound up with this post-apocalyptic Road Warrior type thing.

I think there's going to be some neat stuff in it. We've got the whole outdoor wasteland - big areas, going between lots of different areas. We're doing some of the sandbox play there. I like racing games. Mario Kart is the last game I played reasonably. That type of thing is fun.

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TECH 5 AND MORE

Then you've got the run and gun internal shooter stuff, id's always done well, and we're going to do a good job on that. Then you have the sort of RPG-ish elements, pimping out your ride, getting money to buy accessories and building it up. It is a different style of game which is risky especially when you're talking a $20 million budget, and the safe this for us to do would be to run right into Doom 4. But we made the conscious decision that we want to broaden id a little bit. We've got Wolfenstein, Doom, and Quake. We're trying to bring Orcs and Elves up from the low end, and we're going to try to bring Rage in from the high end to broaden our whole portfolio here. There's no doubt it's a gamble. It's a big deal. There's an element of stress there that we don't have all of the advantages that we previously had going into a title, there. But we think it's going to be pretty cool.

There will be a Doom 4, we don't have it scheduled or a team assigned to it, but there will be a Doom 4. There's going to be a Quake Arena sequel. There's a Wolfenstein thing in production. We're following along with all those. This game doesn't have to be Doom. It's going to be something different.

Billy Berghammer: Now that you're creating something totally different, do you want to make another Quake or Doom game in house, or are you interested in letting your friends - Raven, Splash Damage - work on those games and then you move forward with the engine situation, and creating new IP.

John Carmack: The big changes at id is that we are going to be starting to staff up for a second team.internally. This was mostly driven by publishers where the publishers would come to us and say, "We want to do a Quake Arena sequel, or Doom 4. We'll be happy to work with other teams like the normal id relationship." It's important to realize with a pure technology license with Prey, we kind of tossed the stuff over and "Good luck, we wish you the best, don't bug us too much." With Enemy Territory we have half our company working on that project right now, even though technically it's Splash Damage. There's always a lot of id involvement on an id titled game.

So with the publishers, if we do it in house, they said they'll give us a bunch more money. This came from several publishers on there. Really

significant amounts of delta's there. So we are beginning to staff up internally. We've got a plan to do this.

We have a kernel team and we've seeded it with people from our main team and moved them over, and the plan is right now to do a bridge project that we're calling Quake Zero. This is experimental and this is one of my pet ideas. We're taking the Quake Arena code base data sets and repackaging it for incremental web downloads and make it a free game and we're going to try a sponsored advertising supported free version of the game. I want to try this. Where the website is the hub for everything, most of the menus are gutted out of the game. The game is something that launches instantly. You set up everything on the web page, all of your community stuff there. You get sponsors and advertisers on there to see if we can support this. We have a unique opportunity for this because we own all the stuff on there - it's still a good game. We can do this with the kernel of the first six developers on here.

The goal is here to make - after Quake Zero - then we'll probably take all of the lessons we learn from that interaction and make an id Tech 5 Quake Arena sequel with all the bells and whistles. All of the modern stuff on there. That kind of boot strapping process will be the best path. I expect we'll wind up with 40 something employees. We're still tiny as far as the big studios go. I want to keep us under fifty.

Billy Berghammer: I haven't seen you this excited since you talked about your portable mobile project. What's it like to say again, "we're totally doing something different - here it is!"

John Carmack: It's an exciting time right now at the company. It really is. We've got a great team here. It was a great week last week. We've been going through the features, and we made the video and asked one of the artist, "How's it going?" and he goes, "it's going awesome!" And we have that feeling across a lot of the company where we see how the product is going to turn out and we think it's going to be something that's going to go out there and make a dent and have some impact for us.

There's a lot of trials and tribulations across the development process. There's going to be highs and lows across all of it. I think we're accomplishing what we set out to do. That's really the things that drive me. Here's the problem, here's the goal, here's the tools at our disposal, lets

craft something that's going to get us there, then evaluate how we're doing as were making our way there. I think right now we're doing a pretty good job. There's a lot more left to do and a lot more challenges. I think we'll continue to sit up at the top of the important and relevant companies that are doing the technology for gaming and then the games themselves.

Chapter 22

John Carmack on the Nintendo DS

This interview was conducted by Craig Harris for IGN on Nov 08, 2007.

<http://ds.ign.com/articles/833/833894p1.html>

Interview

Prologue

Next week Electronic Arts will ship Orcs & Elves for the Nintendo DS, a dual-screen conversion of the cellphone design brought to life by game engine guru John Carmack, best known for his work at id Software such as Wolfenstein 3D, Doom, Quake...and the list goes on. The man also had his hand on the Nintendo DS version, building the tech to get Orcs & Elves moving on the portable system.

In preparation of the game's release on November 13th, we had the opportunity to talk with Carmack about his work on the Nintendo DS.

Carmack has also been blogging about his experience on the Orcs & Elves

developer diary. Be sure to check it out.

Questions

Craig Harris: So I heard that you created the engine for Orcs and Elves for the DS in four days. Truth, or an exaggeration? If it is true, how the heck is that possible?

John Carmack: It is true that I wrote the 3D code in four days, but I had a good setup for it. The Fountainhead team had gone through the initial learning curve of working with the DS dev tools, so the game was basically running when I got it. They had also done some test models and a first cut at a non-tile based level model, so I had data to work on the new functionality with.

Once or twice a year I go on "working retreats", where I lock myself in a hotel room for two weeks with no internet connection for completely focused work. I tackled the DS work first this time. I had read the reference guides, I understood what the hardware did, and I had a pretty good idea how I was going to structure everything. Fortunately, I didn't hit any blind alleys, and the implementation went pretty much as I expected it to. After four days, all of the low level functionality for displaying the general purpose 3D levels and moving around models and sprites was implemented, and the Fountainhead team took it back over to finish all the detail work of the game.

Craig Harris: Since this is your first Nintendo DS project, what was it like poking at the hardware?

John Carmack: It was probably the most fun platform that I have personally worked on. The early consoles that I worked on (SNES, Genesis-32X, and Jaguar) had fun hardware and full documentation, but a lousy development tool chain. A lot of later consoles had much better development tools, but they started playing secretive with the exact hardware specs, at least around console introduction time.

While there are a few nooks on the DS that aren't documented, they weren't things I cared about, so to me it was almost perfect. It is a shame that

homebrew development can't be officially sanctioned and supported, because it would be a wonderful platform for a modern generation of programmers to be able to get a real feel for low level design work, to be contrasted with the high level web and application work that so many entry level people start with.

Orcs & Elves makes the move from phone to DS this month.

Craig Harris: Tell us some of the features of your engine, and how that's applied to Orcs and Elves. Can this engine be used for anything but a step-by-step, gridded first-person dungeon hacker?

John Carmack: On projects of this scope, it isn't really accurate to speak of the "game engine" since there isn't all that much code involved. The basic strategy is to just allow the relatively slow CPU to chain together static blocks of data that are ready for the relatively fast GPU to consume, implementing dynamic effects by prepending some state updates before the static data is consumed. I wanted 60hz updates everywhere (I was irritated that Prison occasionally slows down to 30hz).

To the game code, the world is still just a tile map, but for rendering, each map was exported as a general-purpose 3D model, and the artists could then go through it and spend the polygons any way they liked, without the limits of line-of-constant-z software rasterization that we lived with on the mobile phones. You can't render all that many polygons on a DS frame, and you have to keep a healthy reserve to avoid ugly failure in dynamic situations, but the geometric freedom and vertex lighting/colorizing lets it look a heck of a lot better than any cell phone.

High level culling is still done by a front to back walk of a BSP based on the original tile geometry, with a one dimensional occlusion buffer being filled in as segments are processed. This is the thing that is most marginal right now, since if the "prettied up" 3D model diverges too far from the original tile geometry, you can get culling errors. I would do this differently, given a bit more time. An explicitly modeled 2D portal/occluder shell would be faster, more flexible, and slightly smaller in memory, but would require another new element in our production chain. Our next DS title will certainly use code from Orcs&Elves, but there will be significant changes.

Craig Harris: Orcs and Elves seems to approach a game idea that's been left behind: the Eye of the Beholder/Lands of Lore-style dungeon hack. Do you think this style of gameplay is still relevant? Are you concerned that maybe this style might not work in this day and age?

John Carmack: I think World of Warcraft shows that people today still like a good fantasy hack and slash game. I always thought that a lot of computer fantasy games leapt into complex party based play somewhat prematurely. There is a certain type of fun in shuffling things around to min/max your party's combat effectiveness, but that type of gaming is pretty much orthogonal to the basic sense of adventure at the core of an RPG.

It is true that the gameplay for Orcs&Elves was designed around the limitations of mobile phones, and that if we were starting completely from scratch for the DS we would probably do things a bit differently, but the bottom line is that when we sit a random DS player down with the game, they have a lot of fun.

Craig Harris: You mentioned at Quakecon that you're interested in a Quake Arena for the Nintendo DS, but didn't want to approach it control-wise like Metroid Prime Hunters with the mouselook on the touchscreen. Care to elaborate on this? Why wouldn't you want to utilize the touch screen for the freedom of movement?

John Carmack: I haven't ruled any control scheme out at this point, but when I ask people what they think of Metroid Prime Hunters, the response is strikingly uniform: The control seems wonderfully cool at first, but nobody wants to play it for extended periods of time, because the ergonomics are bad. It is essentially like trying to use the right analog stick on a 360 with your left thumb.

I think that there is a somewhat unexplored spot in the gameplay solution space around a game that plays more like classic Doom deathmatch, with dpad+shoulder strafe control. At 60fps rendering speed, aiming control can be quite accurate, and timing based skills somewhat take the place of the extra dimensions of look up/look down decisions. I know for a fact that we can make something fun with that control scheme, the only question is if we can do something else that is even more fun. The DS doesn't care at all whether it is rendering a 2.5D play environment or

a full 3D, 6DOF environment, but if the gameplay gets less fun when you insist on forcing the player to use additional degrees of freedom, it could still be a bad decision.

Craig Harris: Since you're very tech heavy and familiar with the hardware, tell us: have we reached the cap of what's possible on the Nintendo DS? Or do you think there's something coming down the pike that'll really wow us?

John Carmack: It is likely that every significant trick of the hardware has been demonstrated, but software is all about combining basic steps to do unique things, so new things will be seen as surely as new books will be written. In any case, all of the implementation decisions will change as the prices for cartridge memory continue to fall. If we had a 128 meg cart instead of a 16 meg cart, all sorts of priorities would have been different. The combination of larger amounts of non-volatile memory on carts with internet access also opens up possibilities for continuously updated games.

Craig Harris: Do you feel a sense of responsibility for driving the industry forward? Is that something you keep in mind when developing new engines?

John Carmack: Oh, the industry is barreling along just fine all by itself. Sometimes I get to nudge the steering wheel a little. One of the things that is stressing me out right now is that significant decisions are being made about the next generation of consoles and compute accelerators based on large arrays of processing elements, and there is a lot of hand waving going on about how great new things will be done with it, but very little to back it up. I have my own "hand waving" direction that I have been talking about, but until I have the time to actually implement some proof of concept work, I can't speak with any kind of an authoritative voice.

Craig Harris: What's the next big step for games - where you see it moving over the next five to ten years, both in terms of technology and platforms?

John Carmack: I do think that mobile platforms will play an increasingly important role. There are vastly more mobile phones in the world than

there are game consoles, the hardware capabilities are now quite strong, and connectivity is intrinsic. There is still a large issue with poor user input characteristics and widely scattered implementation quality, but I am hopeful that will be improving over the next few years.

Ten years is a long time to look ahead for hardware trends. Some things will not have changed drastically – the HDTV resolutions will probably be the same, and game consoles and controllers will still be recognizable. Processing will likely be done with hundreds of parallel processing units with a flexible division of work. Content delivery will mostly be over the internet, likely in a dynamic streaming style rather than a one-big-download style. Networking could even displace local computation for high end rendering, with cheaper devices essentially streaming media created at locations of higher compute density. I don't think it is inevitable in this timeframe, but significant advances in IO would make the largest difference – direct retinal image scanning, high resolution full body input, etc.

Craig Harris: To the average gaming consumer, what do you think of as the most important aspect to deliver in a game? What are people really looking for, and how are you working to incorporate that into the work you do?

John Carmack: Today, I don't think it is reasonable to speak of the "average gaming consumer", any more so than the "average phone user" or "average book reader", and I wouldn't try to guess what such a large slice of the public really wants anyway. We try to pick directions that a good number of people will enjoy, then just do a quality job implementing it. Some people will love it, and some people will hate it. The people that hate it usually scream louder.

CHAPTER 22. JOHN CARMACK ON THE NINTENDO DS

Chapter 23

The id Mobile Interview

This interview was conducted by GameSpy Staff for GameSpy on Nov 15, 2007.

Interview

Prologue

id Software and Fountainhead Entertainment announced today that the two developers have joined forces to create a new division of id Software, id Mobile. GameSpy recently had the opportunity to discuss the formation of the new division with id Software technical director and co-founder John Carmack, id CEO Todd Hollenshead, and id Mobile president Katherine Anna Kang.

Read on to learn more about the wand-waving future of Orcs & Elves, the upcoming Wolfenstein handheld games and about working with Steve Jobs on bringing games to the iPhone.

Questions

GameSpy Staff: Tell us about how you got involved in mobile development and the formation of id Mobile.

John Carmack: Well, the whole move into mobile a few years ago was sort of a random fluke. The state of the mobile phone caught my eye, and I was basically looking at the games and thinking, "I could do a lot better than this really quickly."

Initially when we made contact with Jamdat at the time to do Doom RPG it was a pretty speculative venture on our part. We had no idea if this would turn out to be something useful, but Jamdat was behind it enough to go ahead and cover all of our development costs on it.

So we went ahead and made Doom RPG and it turned out to be this great big hit. It really exceeded my expectations for what we would get out of the game. We followed it up with Orcs & Elves, which won a bunch of awards and is doing well. Soon we have Orcs & Elves 2 on the mobile phone and Orcs & Elves for the Nintendo DS, which is the first step of my theoretical plan of upward mobility for new IP's on there.

Overall, it's turned into something that we're now sure that we're committed to this. It wasn't going to be the little one-time thing, experimentally, as we started out. We think that this is going to be a significant aspect of our business going forward.

Even if we look at it as the worst case, right now it's a successful business; we're doing well on it. We're building a lot of favorable impressions from people who are playing the games on mobile. It's sure to be growing, at least modestly, over the coming years. There's a decent chance that some time in the next five years or so that mobile gaming could be a real breakout success. There are certainly lots of possibilities when you look at the numbers. There are at least twenty times as many mobile phones as there are personal computers, and maybe a hundred times as there are consoles, so there's certainly a large potential market.

We're just now getting to the point where the common phones that people have, the phones that there are hundreds of millions of out there, are

things that are capable of playing the kinds of games that we like to make and that we have skills at. Obviously there have already been big successes in the puzzle games: the Tetrises and Bejeweled and Pokers and things like that. And that's great that they're doing well, but it's unlikely that we'll start playing in that market because that's just not the type of thing that we do.

The types of games that we do end up working on, the kind of technology-heavy, media-rich games are becoming more credible on those platforms, and I think we're going to be well positioned to make some significant marks there.

Once we reached the conclusion that mobile was going to be a significant part of our companywide strategy in the coming years, it made sense to pull the development team internally. This brings us several advantages.

One of the things that we've had difficulty with over the last couple years is getting good, qualified, talented game developers that actually want to work on mobile projects. In America at least, mobile development is seen as the ghetto of game development. When people say they want to go into the game industry, they're always envisioning working on some cutting-edge high-end Xbox 360 or PC game or something. If they're told, we're going to work on a mobile project, you can usually just see their faces fall. Immediately their position is not something that is highly respected here, even if their sales numbers can be quite large and they can do something that a lot of people will play.

We are expecting that as an id Software division, it will be a little more enticing for people that are interested in development. And it also gives us a better position for dealing with publishers, carriers, hardware vendors, chipset vendors, the whole ecosystem of the mobile space, where we expect to establish ourselves as a significant player.

GameSpy Staff: Do you find that people that express interest in working for id Mobile won't just be using this as a stepping stone for future positions within id? What do you plan to do to make mobile development attractive to talented industry professionals?

John Carmack: It's definitely something that we're going to have to pay attention to. If we poach good developers out of the mobile section Anna

will hit me.

Katherine Anna Kang: I will hit you!

John Carmack: We hope to be able to find people that really love the idea of working on the mobile platform. There is a fundamental coolness to the games living on your cell phone, rather than on a dedicated gaming box. While we can't say that we've run into a whole lot of them yet, I'm still holding out hope that there are people that are incredibly talented and actually specifically interested in the mobile space.

Katherine: The thing about the id Mobile division and the relationship with id Software is that it does not preclude the possibility of people working on the id Mobile division and then going on to other projects. For example, one of our programmers has just moved to an id Software project. But the thing is, id Mobile will stay focused on the handhelds and mobile. As id Software and id Mobile grows, that all becomes a part of how the companies allocate their labor force. There's definitely not a specific plan where we bring people in to id Mobile so that they can step up to id Software, but that's definitely not outside the realm of possibility.

Todd Hollenshead: Just to be clear from an operational standpoint, id Mobile is operating effectively as a separate company. Now, there are a lot of shared resources, the name is the same, and a lot of the drudgery of the business aspect will be handed off to corporate headquarters, if we can loosely call it that. The idea is that everybody is working at the same company. While that's partially true, effectively there will be a wall operationally to separate the operations of the mobile business from the rest of what id does.

John Carmack: I will say there are some positive encouraging signs for this going on. For instance, my lead programmer on Rage would love to work on an iPhone title. That's probably the first inkling that I've seen of somebody on one of the high-end projects that would actually really like the idea of going and working on a mobile title.

The mobile things are getting cool, and Apple is helping that some with the iPhone. In general, as the technology gets better and the capabilities get better, it's more exciting to work on. A lot of people still have this vision where mobile phones are just good for playing Snake or Tetris.

CHAPTER 23. THE ID MOBILE INTERVIEW

GameSpy Staff: That's a question we wanted to ask you, John. Do you see any point in the near future where you're targeting specific platforms like iPhones or Blackberries as some of those platforms become more dominant?

John Carmack: It would be great from our point of view if it did reach any kind of level of dominance. But it's like the decisions we face all the time in our development. Just between Qualcomm's BREW and the Java platforms. The BREW platform is tons better for making games. It's a native code platform, it has strong central control of the API, it's just more sensible in just about every way, and you can make much, much better games on it. But it's only about a third of the domestic market, and a tiny fraction of the European market. If we were to make any kind of a jump first, it would be to get rid of Java first and go to BREW.

When we talk about something like the iPhone, they've only sold about one and a half million units. It's a great success for Apple, but it's a tiny drop in the bucket in the mobile market. Interestingly, I've been going back and forth with Steve Jobs about iPhone development on different things. It's a tough situation there, because when you look at the iPhone, where it has 128 MB of ram and gigs of storage, if you were to make a game that was really targeted to the iPhone and made maximum use of its media potential, there's no way you could sell enough units to pay for the development cost of something like that.

So that puts you in a weird situation that no other game platform has had before, where the hardware has more resources than you can afford to fully exploit, just by development dynamics. Historically, on the consoles and PC, we've always been trying to push to what's just barely possible on the platform. At the rate that some of the cell phones are advancing in power, you're going to be mostly stuck by the artificial limit on over-the-air transfer size. So you're stuck with this incredibly powerful system that you can only download 1 MB or two of content for. But the iPhone will probably bypass that with iTunes based sales, if that all works out.

GameSpy Staff: John, you've spoken on multiple occasions on how you've enjoyed developing for the mobile platform, simply because you have a more immediate effect on the smaller projects this way. How much involvement will you have on id Mobile and the games going forward?

CHAPTER 23. THE ID MOBILE INTERVIEW

John Carmack: The best example of that is certainly the three mobile titles we've gone through, Doom RPG, Orcs & Elves, and Orcs & Elves 2. The games have gotten significantly better each time. I wrote the core stuff for Doom RPG, and updated it a little bit when we moved to the BREW port. I really didn't do that much work on Orcs & Elves and Orcs & Elves 2, aside from a few overview meetings on it. But then it was just recently with the Orcs & Elves DS port where I got to go back in and devote some real quality programming time to laying out the 3D engine and everything on the DS, and that was a lot of fun.

I suspect that now it'll be a similar thing where some groundwork's been laid and there will be another DS project where I only provide technical direction and don't get to actually do too much coding on it, but we'll see. The hope is that in the next year, we'll have four titles from id Mobile, probably two mobile and two DS titles. Probably half of them developed internally and half of them with partner companies.

GameSpy Staff: Is Wolfenstein the next IP coming to id Mobile?

John Carmack: Wolfenstein development is ongoing for mobile phones right now. One of the changes that we're doing for that is we've dropped the lowest end cell phone platform that we've been building for. We felt that was necessary to continue. If we want Wolfenstein to be as much better of a game than Orcs & Elves 2 was than Orcs & Elves, and Orcs & Elves was than Doom RPG, we felt there really wasn't that much more we could do within the low-end Java constraints that we'd been working on. We've chopped out the lowest-end version and slightly upscaled the highest-end version, so it gives us a little more elbow room to do some more creative things and expand the game on there.

None of these future projects have we signed actual deals on yet. We are in a nice position where we don't get locked into any long-term contracts with any publishers. EA is publishing Orcs & Elves 2 for mobile and Orcs & Elves for the DS. We're certainly talking to them about who's going to be publishing the next set of titles, and they're probably the frontrunner. But all of those are still up in the air right now. We do hope to be able to do a simultaneous DS and mobile release of a Wolfenstein-themed game.

GameSpy Staff: What's the strategy for getting id Mobile games on the handheld platforms, like DS and possibly PSP? Are all your major IP's go-

ing to be hitting handheld systems?

Katherine: In regards to how we develop the game, we don't like forcing the game to a platform. We prefer to create a game that is ideal for a platform. So if a particular game doesn't fit for the PSP, we're not going to push it. If a game works great for a cell phone, but due to the mechanics or just everything involved, we won't try to push it on the DS. But if it seems like there's a really good relationship between a game type that would go well across the cell phone and with additional enhancements and perhaps more media be able to expand it further that it can go on the DS, then we'll do that. If it looks like the game has such a rich universe that we can go all out and create an awesome triple-A title type, then we'll bring it up further, if the popularity of the game merits that. Our core strategy is not to get every single platform out there, but to make every single game unique to its platform.

John Carmack: Here's a couple specific examples. Orcs & Elves going from the highest end cell phone, that basic gameplay style was just barely good enough for the DS. We would not try to port a cellphone game up to the PSP, that would have to be a complete design rethink. Similarly, we're thinking of doing a Quake Arena-themed game for the DS, and there's no way I would try and put that on a cell phone now, because the user input fidelity and speed just isn't good enough to do that type of a game.

When possible, we want to be able to go ahead and have things across different platforms, but we're never going to push it when it doesn't make sense. We do hope that if Orcs & Elves is successful on the DS, we'd like to go ahead and build a brand new Orcs & Elves game scaling up higher to the Wii. There's a great waving a magic wand approach on there, but that would be a game that has nothing but the theme in common with the cell phone game, while the DS game was clearly a super pumped up on steroids enhancement of the cell phone game. A higher end version would have no direct commonality to it.

GameSpy Staff: What sorts of resources are you directing towards mobile development and are id Mobile games developed simultaneously for mobile and handhelds?

John Carmack: Right now, the mobile team is only about five people. I get to poke in and do a little bit of work here and there, and there are

some other resources that get claimed in different places. We expect to be expanding that slowly. There's no plan to have a mad rush to hire a whole set of other people, but we do expect it to grow to two complete internal teams, and then working with more partner companies, as id Software has historically done. We build something internally, and then we can work with our partners like Splash Damage or Raven. Some of those companies do similar things to what we do on the high-end, and we want to do the same thing with mobile, where we build a couple solid relationships with outside teams so we can take advantage of everything on mobile at the same time. We do want to see all of our IP's, Wolfenstein, Doom, Quake, Enemy Territory, Rage, all of these will eventually be represented on the mobile and handheld space. We also do want to continue to use this as an opportunity to bring in brand new IP's, like we have with Orcs & Elves.

GameSpy Staff: Are there plans to license out your mobile platform technologies to other developers who want to get into the mobile space?

John Carmack: It's certainly a possibility, but we're not making it part of our core strategy. If people want to talk to us about it, we'd be happy to do that. It's always weird talking about engines or technology on such a small project relative to the large-scale stuff that we do, but it's something that we are open to. As the market matures over the coming years, it's going to follow the same track that the PC space did.

As the development environments get more and more complex, and more effort goes into it, there probably will be a much larger push for licensing. But as it is now, in terms of technical complexity, we're really a lot closer to the original Wolfenstein 3D era on the PC. I wouldn't be surprised as it trends up one more generational notch, we see broader interest in licensing like we did in the original Doom era.

CHAPTER 23. THE ID MOBILE INTERVIEW

Chapter 24

Carmack on id Mobile, Crap Games, and Why iPod Sucks

This interview was conducted by James Brightman for GameDaily on Nov 15, 2007.

Interview

Prologue

GameDaily BIZ spoke to John Carmack at length about the new mobile studio, how id plans to attack the mobile space, Apple's "horrible decisions," overcoming the challenge of developing in Brew and Java for many handsets and more.

Questions

James Brightman: What was the impetus for launching a mobile studio? What's the great appeal of mobile gaming to id?

John Carmack: It's been an interesting journey to get here in that we didn't start off with some grand strategic planning where we decided this was going to be really important. It all started when I got a cell phone and thought the games on it were really bad and we could do a lot better. That led to Doom RPG, which was a big success. Then we followed up with Orcs & Elves and now Orcs & Elves II coming out... By testing the waters like this we've found out it's a viable business right now, we're doing good business, the products are successful and profitable, we've got a plan laid out for a bunch of new things we want to be doing, but I think there's really some significant potential.

The worst, most pessimistic case is that we could carry on as we're doing right now, doing successful games and having fun with all of this, but I think over the course of the next five years or so there's the possibility that the mobile gaming market could wind up becoming significantly larger than some of the traditional markets. There are 10 to 20 times as many mobile phones as there are personal computers and 100 times as many as there are console platforms. As these things evolve into devices more like the media powerhouses we're used to developing for, there's a possibility we could have a breakout success there. I think if we go into this thing thinking we'll do our best, we'll be successful, then we may be positioned for something that could be a really significant tipping point some time in the next five years or so. Mobile gaming really could take off.

James Brightman: Everyone keeps talking about the huge potential of mobile gaming but the percentage of wireless subscribers actually paying to download games remains quite low. How do you see that changing and how does id plan to help push the sector forward?

John Carmack: There are a lot of reasons why mobile gaming is the way it is right now, and my initial assessment is probably shared by a lot of people. Most of the games are just crap; there are a lot of really bad things and shareware type games that people would give away for free on the PC. There aren't nearly as many cases where you take a professional team

of developers and try to do something really good. [That said,] you are also significantly hamstrung by the platform itself... the download limits, restrictions in the APIs, huge variability across the hardware platforms and the carriers. It's an ugly market from a developer's standpoint.

Consoles are clean and wonderful. You produce one title and it goes through one publisher and you sell millions of units if you've got a good title. In the mobile market, it's ugly like a retail business. Domestically, you've got a handful of carriers and that's reasonably clean, but then when you go into Europe or Asia, where half or more of your market is, you're dealing with dozens and dozens of different [carriers] and it's a model that's not really comfortable for a lot of software developers. The tiny customization that you have to do means that the sort of hardcore technical programming winds up being not as relevant because you could do something that's spectacularly clever on one platform and have it be something that doesn't even work on a whole of other ones.

You have to approach it in a very different way, but I do think it's clear that the games are getting a lot better. In the last couple years I'd like to think that we had something to do with that with Doom RPG and Orcs & Elves being critically acclaimed titles that sold really well. I know for a fact that we were instrumental in having Sprint raise their over-the-air download limit and to allow us to do a high-end Java version to make it look somewhat competitive with the Brew version. Initiatives and little things like this will allow games to improve a lot more over the coming years to the point where they won't necessarily be an embarrassment to look at. You'll be able to have games on the cell phone that look like games on other portable platforms like the DS and PSP. There's no doubt that right now there are cell phone handsets that have all the hardware power necessary to be significantly better than the DS, but you don't see that in the games themselves for all of these non-technical reasons.

James Brightman: Considering it's been reported that your interest in Linux has wavered, would games be coded in Java or something else?

John Carmack: Right now we develop four primary versions of a title on mobile: a low-end Java version, which is limited to like 350k download size; a high-end Java version, which adds some extra features and takes it up to around 2 megs; a low-end Brew; and a high-end Brew. There's

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a vast difference in what we can do in the games between Qualcomm's Brew and the Java platforms. You're much closer to the hardware and you can actually write typed assembly code if you need to, so the best looking games right now are definitely Brew games. If people can afford to develop strictly for that they'll make much better games.

Unfortunately it's only about a third of the domestic market and a tiny fraction of the European and Asian markets. So the industry is definitely not united and [mobile] is not a great developer's platform because of this huge amount of diversity. If we were left to our own and the only idea was to make the best possible mobile game, we would develop for some high-end Brew platform and we could make a spectacular, stellar but it would only be seen by a relatively small fraction of the mobile playing market. It's one of those tradeoffs. We're obviously not going for everybody or else we would be developing 64k card games - these relatively modest games that can run on anything - which a lot of people think is the key to success in the mobile market. But we're happier developing more sophisticated games that are better games but can only hit a somewhat smaller fraction of the market. If we establish ourselves here I think we'll be well positioned as the hardware market sort of catches up with where we're going.

James Brightman: id's announcement that Rage was coming to Macs was a huge deal. Since you seem to have a long personal interest in Macs, might future games from Fountainhead/id come to the iPhone or iPod?

John Carmack: We've certainly been looking at it but Steve Jobs and I have not been seeing really eye to eye on a lot of important issues. We were in a fairly heated argument at the last WWDC [Worldwide Developers Conf.] and we've had a few follow-ups. I have an iPhone right now and it's a platform I would enjoy developing for but Apple is not taking progressive steps in regards to [gaming]. Their strategy seems to be working just fine from a business standpoint, so I'm not going to second guess them and tell them they're being fools or idiots for not focusing on this.

The honest truth right now is that Apple's not exactly hugely supportive of this. When they finally allowed games to be put on the iPod... in many ways it's one of the worst environments to develop games for. You have to work on an emulator... just all these horrible decisions. I expressed my

fears directly to Steve Jobs that some of these mistakes might be carried over to the iPhone, so they're at least aware of all of them, but they're not giving any spectacular signs that it's going to be a big deal for them in the next year.

James Brightman: There was an interesting mobile news announcement recently from Google, which launched the Android OS with multiple phone makers and even carrier networks. What type of impact, if any, does that announcement have on id's mobile business?

John Carmack: It might, but I've not looked at all the details of what they're doing. The most important thing for us is native code execution. Java was sold in many ways as a security architecture, and there's some truth to that at least on early cell phones... but for modern cell phones with virtual memory and memory management units, traditional OS methods really are appropriate. And that was my big argument with Steve Jobs about the security measures on there. If you've got a real OS and a real MMU on there, you can have secure native mode applications just like you do with any traditional Unix system. I certainly hope that becomes the direction things go in. Java still does have the benefit of being able to run across different CPU architectures but Qualcomm seems to be content with saying ARM is it. If we can get away with that and say ARM owns the mobile space, as a software target it would be much, much more desirable from a developer's standpoint.

James Brightman: In terms of your mobile games strategy and your portfolio, are you looking to create new IP, just continue with IP that's been working like Orcs & Elves and Doom, or both?

John Carmack: Orcs & Elves was actually the first new id Software IP since Quake. While we were working on Rage, our big high-end title, we were able to sneak Orcs & Elves after Rage was started and ship it well before Rage was going to ship. The fact that we could get that out and have it be successful I'm really pleased with. So we intend to pursue both; we have additional new IPs we're going to be specifically aiming at the mobile market, but we're probably going to be hopping back and forth between traditional id IPs and new IPs. The project under development right now is the Wolfenstein-themed project. We are probably going to try to do that simultaneously on mobile and DS, which would be a first

for us. We're still sort of feeling out all these different strategies about where IPs start and where they go, whether it's simultaneous or subsequent development.

James Brightman: What's the plan for marketing and publishing id's mobile titles?

John Carmack: Currently we're working with EA, but one of the nice benefits of being id Software is that we can get away with signing only one-at-a-time publishing deals. We don't have any long-term deals tying us in. We're reasonably happy with the support from the Jamdat guys that are now a part of EA, but if another publisher wants to make us a really good offer we're certainly willing to listen.

Todd Hollenshead: For example, Orcs & Elves II is being published by EA but beyond that when we've talked about the future of what id Mobile is going to be bringing to the market, those titles are all completely unsigned.

James Brightman: You touched on this a bit before, but in terms of the power of the mobile handsets and how they could easily eclipse the DS, obviously not every handset is created equally. And as PC developers you are quite familiar with trying to create something that'll work across numerous specifications, so when you're optimizing these games for mobile how do you make it playable across handsets?

John Carmack: In that respect it is actually worse than the PC. The PC feels bad compared to the consoles - whether you're on a DS or 360, it's great because you have one target, but on the PC you might be scaling over a factor of four. On mobile we're scaling over a factor of at least 10, and that's pretty grim. So we make significant gameplay decisions that strategically at the very beginning have to affect all of that.

Katherine Anna Kang: So far I think the strategy that's worked for us is that we have four versions (high-end and low-end for Java and Brew), so we know that the lowest version of the game should never look or play worse than the lowest that we've developed and given to the publishers. So we have a very, very bottom and a very, very top, and after delivering those to the publishers they will take those versions and port it over to the hundreds of handsets that need to be taken care of.

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James Brightman: I would assume that significantly raises the cost of development, right?

John Carmack: Oh yeah, it definitely does. It's hard to say what the breakpoint would be, but we do feel that it's fairly necessary for what we're trying to accomplish. We could do some profitable games if we were high-end Brew only, and they would be much flashier and more impressive, but we'd be serving a much smaller chunk of the market and we wouldn't be able to accrue the consumer goodwill and broad based IP market growth that we're trying to do. The thing about the cell phone market is that it's possible to go out there and sell millions of units. These are good numbers just to have people say, "This is a great game." Whether they played it on mobile or some high-end platform, if they think, "Orcs & Elves, that was a great game..." then we've built some long-term value that the company's going to be able to take advantage of for year's to come. And while we might still be able to make money doing a high-end only Brew game, and in some ways it would be a much more fun thing to develop, we would lose out on that broader sense of a couple million people having favorable impressions of the game and company and so on.

James Brightman: And finally, the first games to come out under this new mobile studio are expected when?

John Carmack: The Wolfenstein title is under development right now, and we expect that to follow the previous [pattern] of taking six months to develop...

Katherine: The idea is that if we do the code release of the cell phone and DS version of Wolfenstein, we'll definitely have it out for next year's holiday. If we don't do the code release, the cell phone version won't be out before the DS.

John Carmack: My ideal would be if we winded up developing two titles internally and then we probably work with maybe two other outside studio teams to develop two more products, like the Quake Arena project we're talking about for the DS and possibly deal with somebody else on another mobile title. Ideally, I would hope to see four mobile titles coming from id Mobile next year.

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Chapter 25

1UP Interviews John Carmack on id Mobile

This interview was conducted by Scott Sharkey for 1UP on Nov 16, 2007.

http://www.1up.com/do/newsStory?cId=3164439

Interview

Prologue

Yesterday, id Software and Fountainhead announced they're opening their own mobile gaming division. That all seems to come a little late, since they've already been making some of the best damn mobile games for the last couple years. Give Doom RPG or Orcs & Elves a shot if you're still clinging to the belief these things universally suck.

We had a chatter about it with id CEO Todd Hollenshead, Fountainhead CEO Katherine Anna Kang, and nerd-everyone-wants-to-grow-up-to-be-just-like, John Carmack. Between making games and blowing up rockets, (it's okay, he has another one) we don't know where he finds the time, but we're glad he could spare some to geek out about the prospects of devel-

opment on mobile and Nintendo DS.

Some of the more interesting points that came up included the mention of Duke Nukem games in the works for mobile and Nintendo DS, and an incarnation of Quake Arena for DS exclusively. We even talked a bit about a D20 pen and paper module coming out based on Orcs & Elves, which was in turn based on the tabletop RPG campaigns he used to DM a million years ago.

Questions

Scott Sharkey: So, new venture I guess, sort of.

John Carmack: Yeah, it's definitely a "sort of", because we've been doing the mobile stuff now for two years just in partnership between Fountainhead and Id. But we decided we're happy enough with how things have been going, the business has been good, and we think that the potential is really strong looking the next several years ahead, that we decided it's better to just go ahead and build an actual Id software division around this.

Where we think that it's going to help us – I track more people interested in working on the mobile stuff, it's going to let us use our clout more with the carriers, the handset manufacturers, the chipset manufacturers, and all that. But at least in the immediate future, it's still going to be carrying on as we have been. We've got new titles under development with Wolfenstein, some other projects that we're going to be working on, new IPs and all that. But we do expect to be slowly ramping this up, with pretty substantial commitment over the next several years.

Scott Sharkey: A lot of DS development possibly?

John Carmack: Well, we're definitely very excited to see how Orcs and Elves DS does. It's coming out next week, and that's also the first step& there's two aspects to this, it's our first DS title at all, but also it's the first test of this upward mobility theory about testing out a project on the mobile platform, and then see how it does moving it up to more conventional platforms on there.

The DS development was a lot of fun, in a lot of ways it was kind of the most fun poking at the hardware sorts of stuff that I've done in a long time. So we're currently looking at potentially two more DS titles in the next year a Wolfenstein title and a Quake Arena title. Wolfenstein 1 being done in concert with a mobile title, the Quake Arena title would be DS specific.

Scott Sharkey: So you are going to be doing exclusive stuff for DS sometimes?

John Carmack: Yeah, I mean it all depends on what the title is on there. You can't do a good shooter on mobile. If you picked one mobile phone, you might be able to do a good job on it, if you picked a high end BREW or Symbian phone and targeted it specifically for that, that keypad layout, you could maybe do something decent, but it's not something you can do a broad-based, good game on. So for that type of thing, and Quake Arena is all about the competition, super-fast reactions and all that, that's something that just isn't going to play well on mobile. We're never going to try and cram a square peg into a round hole with this. That's kind of our whole theory behind the mobile stuff, is, we're going to do things that work well on mobile, rather than try to do the things that we're historically known for and push it onto mobile.

Todd Hollenshead: In fact, we have significant amount of experience as to how the square peg/round hole stuff doesn't work. We actually made some money off of that, but it was always exercises in how much we could tolerate our games being tortured from a playability standpoint. Because somebody would always come up with some new operating system on a PDA, or some new capability on a specific handset of a cell phone, and somebody would say because whatever game from Id has been open-sourced, I can make a technical case about how this would work. It always ended up being some kind of technical novelty, that sort of looked neat but wasn't anything that people actually wanted to play. What we did with Doom RPG, which was the completely opposite approach: what works on a handset, and let's combine this with something in the Doom universe. And that actually was not only a commercial, but a critical success.

Scott Sharkey: Yeah, I was really happy with that, it really played to the

strengths of what you had available.

Todd: So that's the model, and we hope to replicate that and improve upon that as we go forward to more advanced handsets, into the DS market, etc.

John Carmack: We want to use as much synergy as we can. With Wolfenstein, this may be a great case where we can have a mobile title out, we can have a DS title out, and both of those should come out in advance of the big cross-platform, high-end Wolfenstein title that's under development right now. And that may come out being almost perfect timing, where we can go out and move maybe a couple million units on mobile and DS, in preparation for the big high-dollar one going out on the PC, 360, PS3 SKUs on there 6 months later or something.

Scott Sharkey: With Orcs and Elves, I think there was some difficulty with the development in porting it down for lower end phones. Is that going to be a problem? Are you going to be developing from the DS down, or from lower end phones up?

John Carmack: Well right now we have made the decision that the next mobile title is dropping the lowest end Java support. I felt that was necessary, where we made good strides from Doom RPG to Orcs and Elves, and Orcs and Elves 2, the game got better each time. It wasn't just that a matter of changing the graphics and making new levels – there were significant improvements in each step that we took there. I was pretty much convinced that we were at about the limits of what we could usefully do on the lowest end platform. There's still lots of room for us to expand on the high end BREW or Java platforms, but if we're continuing to require that we ship on a 350k Java, it would have kept us from being able to make that kind of step again.

So for Wolfenstein, we cut off the lowest end, which throws away a decent chunk of the market, but we do think things are still moving from a platform migration standpoint. And we think we'll be able to make enough, better of a game that it'll make up for giving some of the low-end away there.

Scott Sharkey: So it should offer a lot more freedom now, then?

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John Carmack: Yep. We always look longingly at the possibility of, if we could develop just for high-end BREW, we could make games that would be, really, every bit as good or better than a DS game. Really it's worse on mobile, than any other platform, where the consoles are sort of the best – you've got a one point target. PC space you might have a factor of four performance that you're scaling for there. But on the mobile we've got well over a factor of ten from the lowest end and the highest end, where you've got something that might be at 16 mhz processor on the low end, and a 300 mhz processor on the high end, or even higher. There are 1Ghz processors going into cell phones right now.

Scott Sharkey: How do you feel about mobile development? I understand there's a lot more opportunities for hands-on individual work, compared to the huge teams and budgets.

John Carmack: So our current teams that have done all these titles have usually been five or six people, and we expect that to still be staying fairly constant through the next year. Now I do think that it's inevitable that if the market grows, and you have bigger and bigger successes on there, that it will inevitably follow the path that PC and console games have had, where ten years from now we'll be talking about the twenty million dollar developed mobile game, probably much less than ten years actually. But I think for the next several years it will grow reasonably slowly.

There's also this interesting phenomenon, where because the gaming isn't what's driving the technical decisions on the cell phones, we're sort of reaching a case where modern high-end cell phones have more resources than we can actually afford as game developers to take full advantage of. Which is a bizarre situation that we've never seen on PC or consoles for a high end game, where you're always trying to eke every last little bit out of the platform. But when we look at a high end phone like an iPhone or something, that might have 128 megs of ram and gigs of storage, if you built a game and said I'm going to do the best possible thing on this platform, you could go ahead and spend 5 or 10 million dollars developing some really lush media platform on there, and you would never be able to sell enough units to go ahead and justify that from a risk standpoint.

So mobile development is going to remain different in interesting ways than the rest of the console or PC development there.

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Scott Sharkey: So it's a matter of finding a sweet spot between innovation and expense?

John Carmack: Yeah, if you shot just for the low end, then you can say I'm just going to try to max out the low end platform on here. Although you've still got the issue of, it has to then be customized 150 different times for all the different handsets. That was one of the things that was interesting doing the DS work recently, where for Orcs and Elves DS I personally had a blast working on that because it was this tight, low level hardware thing where you could go in and poke at registers, and if it worked great on this one it would work on every single DS ever made like that. And it was a very different feel from the cell phone development, where you have to do a good sort of strategic job on there, but the tiny little tactical decisions, about programming implementation, you can't get much leverage out of that, because it's going to be different on 150 or 300 different cell phone SKUs that you wind up developing on.

I know when I very first started playing with cell phone development on my personal cell phone, I spent a little bit of time doing Java disassembly, and tweaking things to generate the exact op codes that I wanted, but it was really pointless in terms of a larger, broad scale commercial release, because any tweaks I did on that would only be hitting some minor fraction of what the total market was.

Scott Sharkey: With the lower budgets and few people breathing down your neck, is there going to be more opportunity to do things that we haven't seen before?

John Carmack: Orcs and Elves was the first new IP that Id software has created since Quake about ten years or so. We're working internally on RAGE, our big new high end IP, and the fact was we were able to sneak in and do something we haven't done in a long time, and be successful with it on the mobile platform. I think that's a really good sign, that it's out there, and that it was successful critically and commercially. We're all waiting, eagerly anticipating how Orcs and Elves DS will do, because if that comes out really good also and show how we were able to pioneer a new IP on the low end mobile platform and then step up to a more conventional platform, then we'll probably try moving that again. And that would be a great existence proof for the industry, and I know a lot

of people at EA are looking very carefully at this, because it could be a significant new change in the way people think about trying out some of the new IPs on there.

Katherine Kang: I think one of the ways that developers can come up with new ideas is, with the mobile market, with the DS market, but particularly the mobile market you can throw a lot of ideas in there with a very low budget and see if people take to it. If they do, then you may already have a fan base that enjoy that game, that may see it as a benefit to go to the more higher end games.

One of the things with Orcs and Elves that will be very interesting is in the cell phone market, nobody really knew anything about it except that it must have orcs and elves. You know it was very special, it was a really good game for the cell phone, and people really liked it, and Orcs and Elves 2 that's coming out in a week, next week, is an even better game than Orcs and Elves. People who played the original Orcs and Elves seem to want more of the Orcs and Elves, the idea being that the DS is still a very good budget to work with, but not extravagant. We give them more, and if people like this approach, then I think a lot of more innovative new type of games will come out of the studios, because they won't have to risk tens of millions of dollars in just trying something they would have liked to try but couldn't afford to.

John Carmack: I think one thing that's kind of worth recognizing is that if somebody played a mobile game, and if they think "Orcs and Elves, that was a great game", and it's in the context of, "this was a great mobile game", that people still have that same positive feeling about it, you're building pretty much the same brand loyalty that you would if you were developing a great game on the 360 that cost 40 times as much to develop.

Scott Sharkey: Do you think that will help in terms of, people will buy Orcs and Elves DS and with the sequel out already on mobile, that people will seek that out?

Kathering Kang: That's the idea. The idea is that if the people who played Doom RPG, played Orcs and Elves, that they would go buy Orcs and Elves 2. But with Orcs and Elves 2 out there, the people who perhaps pick up Orcs and Elves DS and enjoy it and go "wow, this is a fun little game, I

wish there was more to it", then they can go on the cell phone and be introduced to the same universe, with some of the characters that they became accustomed to, and continue enjoying it. And after playing Orcs and Elves 2 on the cell phone, that they'll be like, "oh boy, can't wait until Orcs and Elves 2 is out on DS" or another platform. But rather than having to wait 3, 4, 5 years, next year they'll be ready to pick it up.

John Carmack: There is a danger there though in that the DS is nicer in a lot of ways. It's very fast and smooth, better graphics, more levels, all this, where especially if somebody had a low end phone, they would be sorely disappointed if they went from playing Orcs and Elves on the DS, to playing Orcs and Elves 2 on a low end Java phone.

Kathering Kang: It could potentially go a positive way, though, where the gameplay experience is still fun. So they could play it on the cell phone, and say, I can't wait to see the DS version, to see what more there is that we weren't able to see on the cell phone.

John Carmack: But that would be an interesting situation if we were in, where we have a huge hit on the DS, and then people wind up seeking out the mobile version for the next step in that. Then there would have to be some expectation management in effect there.

Scott Sharkey: It's definitely an interesting experiment. Do you think you might do any development specifically for the DS and then expand that downward?

John Carmack: Well we are definitely right now looking at the Quake Arena title on the DS, which will be a DS exclusive game, again because we don't feel that we could do a good job on a Quake Arena style game across any kind of broad mobile platform. So we're sticking to, we'll do what's appropriate for the different platforms.

You're never going to see us say, well we're now doing, say, RAGE, and we're going to go ahead and do RAGE on all the high end titles, we're going to do a mobile version, we're going to do a DS version, because specifically I don't think we can do a good version of a racing game like RAGE on the cell phone and do a particularly good job at it. It's not outside of the realm of possibility, you could push it and possibly make something happen, but I don't think it's the right thing to do. The same thing with

what we were talking about with Quake Arena, and similarly I think that there are things we could do on a mobile title that won't translate well to other games.

We have a lot of ideas that we've talked about, about things that could actually take more advantage of the specifics of the mobile platform, with the always connected nature of it, things that are interacting with live internet connections, or SMS messaging, or any of those things that would clearly be mobile only. Where we want to get the synergies that we can, out of the fact that we have these IPs present on multiple platforms, but it's not going to absolutely drive everything that we do.

Scott Sharkey: One last question about Orcs and Elves, the story was that was a [D and D] campaign that you ran?

John Carmack: Not specifically. Orcs and Elves is Anna's creation, mostly from scratch, but she was inspired by some of the things that I did previously. Certainly the actual gameplay style that we developed for Doom RPG was things that I dredged up out of my early gaming experiences, and the computer games that I remember playing as a teenager, the Wizardry and Bard's Tale and games like that. So we've been tagged as a retro game in that, because people can think about Eye of the Beholder and classic games like that. It's not intentionally being set up like that, it's more a matter of, what was going to work well on the cell phone for play style, and dredging out all the different possibilities, that just came out on the top of my list, that that would work out well.

Scott Sharkey: Do you have any remnants of any of those old games? I'm sure the scenario is different, but It'd be fun to see a character sheet or something.

John Carmack: Yeah, I actually have a bookshelf full of my old campaign notes still in my office upstairs.

Katherine: We actually have a D20 coming out based on Orcs and Elves, that I believe should be released either next week or the following week, for the people who are still playing Dungeons and Dragons.

John Carmack: It's actually kind of neat, one of the guys at EA was involved in writing some of the D20 based adventures, and he put a lit-

tle module together based on something happening at the periphery of the Orcs and Elves game, and I reviewed all that a couple days ago, and passed along a couple of tiny notes. But I thought it was pretty neat, what they did with it.

Chapter 26

Gamasutra interviews John Carmack and Katherine Anna Kang

This interview was conducted by Gamasutra for Gamasutra on Nov 23, 2007.

http://www.gamasutra.com/php-bin/news_index.php?story=16352

Interview

Prologue

Veteran Texas-based developer Id Software recently announced Id Mobile, a new division of the famed Doom and Quake creator that will develop games for cell phones, as well as for both the Nintendo DS and PSP.

Id Mobile will be headed up by Fountainhead founder Katherine Anna Kang, who was formerly director of business development at id, and has already worked with spouse Carmack on projects including Doom RPG and Orcs & Elves, the latter of which (pictured) recently shipped on Nin-

tendo DS.

Gamasutra sat down with Id Mobile's Kang and Id's legendary Carmack to talk about the endeavor, a planned Wolfenstein mobile/DS title, possibilities for a Wii version of Orcs & Elves, why Carmack has warmed to Nintendo platforms, and more.

Questions

Gamasutra: Why form a separate division instead of continuing to create games from Fountainhead, the way you had with Doom RPG and Orcs and Elves?

John Carmack: Working with Anna allowed us to try things out and experiment, but once we decided it was successful, there are certain things that are easier to deal with at Id. For one, no three-way contracts!

One of the funny things about mobile development work is that the game is often finished before contracts, which is just ridiculous! So this certainly simplifies things. Another aspect is we have a bit more dev cash at Id, and we're hoping it will be easier to attract interested developers. That's been a little of an issue at Fountainhead – finding talent that's interested in working on these smaller platforms.

Katherine Anna Kang: With two separate goals and separate companies, rather than investing in your future and your people, you're kind of on your own. Overall, it was a good combination for the titles we want to develop, but also the quality we want to focus on, and the type of titles we want to focus on.

Gamasutra: So how much will you focus on mobile games versus portable systems? Do you think you'll continue to sort of test concepts on the mobile phone and then expand on them for DS or PSP as appropriate?

John Carmack: We're really looking forward to seeing how Orcs & Elves does on the DS. It's looking like now like our first project is going to be a mobile/DS Wolfenstein-type title. After that, we'll do an original title on the mobile, and what happens after that will determine how we go from

there.

Katherine Anna Kang: I think the general idea is that we definitely want to make games for the known Id IP –Doom and Wolfenstein – but what we will probably be doing is something between the two: One year a known IP, the next year a new IP, and back and forth. We have a lot of great ideas that haven't been explored yet, and we're really excited and interested. We're also excited to be bringing the classics onto the cell phone or DS.

Gamasutra: A lot of people are very interested in seeing Doom RPG come to a portable system, and when we last talked, Anna, you said to that you were concerned about the DS's audience skewing a bit younger, and the risk of an M-rated title on that platform. If you guys are going to be developing for PSP now, do you think we might see more of the intense sort of hardcore Id games that everyone loves hit portable systems?

John Carmack: Well, we have a few things that we're looking at as sales of DS stuff goes on this year. There are a couple new mature-rated titles coming out for DS we're going to be watching the sales numbers on, and EA will be looking at all this as well. Certainly, there are good games we would like to do that would be M-rated, but I'm hedging my bets on that right now where I think it's still kind of risky, but I would love to be proven wrong!

It is an interesting question, about whether we design games to be able to cross between DS and PSP. It's a little bit tough because there's a broad hardware gulf between the two just in terms of power, processing, memory – pretty much across the board. We did one experiment with Orcs and Elves – scaling up a high-end cell phone game to the DS, but from the DS to the PSP is probably straining a little bit. Whether we wound up designing something that could span between DS and PSP... that would be an interesting challenge, to do something that's really good on both platforms.

Katherine Anna Kang: My goal is to convince him that Doom on DS must happen!

John Carmack: If Orcs & Elves is successful on the DS, we would like to consider scaling that up to a higher-end sku on the Wii – waving the magic wand around and all that would make a neat entry point onto that

platform.

We ignored Nintendo for a long time for a number of fairly good reasons — we hated dealing with them 10 years ago, as they always lagged behind the front runners in terms of raw technology... now we're branching out onto lower-end platforms, so now its an interesting platform for us to be looking at. Six months from now, when our current projects are done, we have all sorts of options we're focusing on. It really will depend on how things go sales-wise on Orcs & Elves for DS.

It's a great situation we're in – even if we stuck with two mobile titles a year, it's already profitable and rewarding. The way I look at it is, even if nothing improves, even if we stay as is, it's still a nice business for us to be in. And the exciting part is that there is a real chance over the next five years that mobile gaming on cell phones could really take off. It could be five times larger in four years if certain things happen, but even if it doesn't, we're still okay.

Gamasutra: What's it like to be sort of a "game industry power couple"? Do you sometimes feel extra pressure when you do things together? Is it sometimes challenging personally to be a husband-and-wife team?

Katherine Anna Kang: I think from my perspective, it's really fun to work with John. I think I kind of take for granted that a lot of people would love to be in my position, and brainstorm game ideas with John! We do have an interesting kind of relationship – I'm purely a designer, I come up with a lot of different ideas, and John is pure tech - so sometimes, we end up kind of speaking different languages, and kind of cross paths, instead of meeting. It is a little bit different in the sense he's talking tech and I'm talking design and we don't quite get what each other is talking about - but we always end up together.

It's really fun working with John – I think that sometimes I wish I could clone him so I could have him just working on my products, but he must be shared! And I think it's also really nice, because were both workaholics. We work a lot, pretty much seven days a week, always working in one way or another. To be able to spend that extra time, and have that much fun talking about games - it's really, really fun. I think that for John's part, when he's working with me... he's less likely to be able to put his foot down!

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John Carmack: There are some funny stories about that. The situation is different now from our very first game. A significant aspect of my values in the design skills I have is in minimization. Keeping a project from going off the rails is half the battle, keeping things from getting screwed up. There are a lot of things I would dismiss out-of-hand, and say, 'oh, no, we don't need that' - but in Doom RPG, the first project we really worked together on, Anna had a few features that she really wanted to get in, and twisted my arm a little bit.

They turned out to be things that people really liked! I remember scoffing at the whole idea of the fire extinguisher, as going around and putting out fires. I was like, 'why would you want to do that?'

Katherine Anna Kang: I thought it was really hilarious, the idea of having it as a weapon, because you had these fire demons flying at you...

John Carmack: But going around and... putting out fires? What's the point? But then, when we watched people play it, we saw so many people just putting out every single fire in the level.

Katherine Anna Kang: But the biggest argument was the doggie. I liked the idea of having a dog in the game, and really liked the idea of converting it into a friend. And John was really anti-doggie...

John Carmack: Anna was like, 'Can we have a doggy?' I was like, '...No.' And it went on like that... but then I finally came up with an idea that was a good way to do it.

Katherine Anna Kang: What I had to do convince John it would work is, I had my designer, and I said, 'look, this is the idea, let's just show it to him'. Once he saw it, he kind of went '...Okay. I think this will work.'

John Carmack: And since we've seen a couple of those things turn out well, I'm much more willing to trust Anna's judgment, even if my first reaction is 'no, we don't need it'. Not because her ideas are bad, but because there is just so much value in drawing the line.

Katherine Anna Kang: One interesting thing about Orcs & Elves 2 is that it has a mouse familiar. I think initially he wanted to scoff at the idea of the familiar. I could tell he was just about to pan it, but then he kind of held his tongue and said, 'we'll see.' And it turned out really well, and

everybody loves the little mouse. And in the end, even John really liked it. I think that after what, four games now, he has learned to not cut me off, and listen to me, and see how it goes!

John Carmack: It works out really well.

Gamasutra: So obviously you can't say specifics, but what can we look forward to in the pipeline from the Mobile division?

John Carmack: Wolfenstein is definitely under production right now. We're expecting more titles for both mobile and DS, and these early mobile SKUs we have been doing, we want to improve. We feel we're up against the limits with the current set of platforms; we think we've tapped out what we can do, so we're tossing out the low end and still innovating some more.

We'll probably do some simultaneous mobile and DS [releases] - and there are a lot of things, depending on what publisher interest is and how Orcs & Elves does on the DS, we could wind up with any of three or four different directions, and we may not know for four or five months.

Chapter 27

John Carmack on id Tech 6, Ray Tracing, Consoles, Physics and more

This interview was conducted by Ryan Shrout for PC Perspective on Mar 12, 2008.

http://www.pcper.com/article.php?aid=532

Interview

Prologue

In recent months a lot of discussion has been circulating about the roles of ray tracing, accelerated physics and multiple-GPU configurations in the future of PC and console gaming. Here at PC Perspective we have heard from Intel on the subject many times and just recently sat down with NVIDIA's Chief Scientist David Kirk to discuss the ray tracing and rasterization debate.

Many of our readers, as well as comments across the web, asked for feed-

back from the developers. It makes sense - these are the people that are going to be spending their money and time developing games to sell on next-generation architecture so surely their opinions would be more grounded in reality than a hardware company trying to push their technological advantages. With that in mind, we spent some time talking with John Carmack, the legendary programmer at id Software famous for Wolfenstein, Doom, Quake and the various engines that power them. What started out as a simple Q&A about Intel's ray tracing plans turned into a discussion on the future of gaming hardware, both PC and console, possible software approaches to future rendering technology, multiple-GPU and multi-core CPU systems and even a possible insight into id Tech 6, the engine that will replace the id Tech 5 / Rage title.

The information that John discussed with us is very in-depth and you'll probably want to block off some time to fully digest the data. You might also want to refresh your knowledge of octrees and voxels. Also note that in some areas the language of this text might seem less refined than you might expect simply because we are using a transcription of a recorded conversation.

Questions

27.1   Ray tracing for more than rendering

Ryan Shrout: Let's just jump right into the issue at hand. What is your take on current ray tracing arguments floating around such as those featured in a couple of different articles here at PC Perspective? Have you been doing any work on ray tracing yourself?

John Carmack: I have my own personal hobby horse in this race and have some fairly firm opinions on the way things are going right now. I think that ray tracing in the classical sense, of analytically intersecting rays with conventionally defined geometry, whether they be triangle meshes or higher order primitives, I'm not really bullish on that taking over for primary rendering tasks which is essentially what Intel is push-

ing. (Ed: information about Intel's research is here.) There are large advantages to rasterization from a performance standpoint and many of the things that they argue as far as using efficient culling technologies to be able to avoid referencing a lot of geometry, those are really bogus arguments because you could do similar things with occlusion queries and conditional renders with rasterization. Head to head rasterization is just a vastly more efficient use of whatever transistors you have available.

But, I do think that there is a very strong possibility as we move towards next generation technologies for a ray tracing architecture that uses a specific data structure; rather than just taking triangles like everybody uses and tracing rays against them and being really, really expensive. There is a specific format I have done some research on that I am starting to ramp back up on for some proof of concept work for next generation technologies. It involves ray tracing into a sparse voxel octree which is essentially a geometric evolution of the mega-texture technologies that we're doing today for uniquely texturing entire worlds. It's clear that what we want to do in the following generation is have unique geometry down to the equivalent of the texel across everything. There are different approaches that you could wind up and try to get that done that would involve tessellation and different levels of triangle meshes and you can could conceivably make something like that work but rasterization architecture does really start falling apart when your typical triangle size is less than one pixel. At that point you really have lost much of the benefits of rasterization. Not necessarily all of them, because linearly walking through a list of primitives can still be much faster than randomly accessing them for tracing, but the wins are diminishing there.

In our current game title we are looking at shipping on two DVDs, and we are generating hundreds of gigs of data in our development before we work on compressing it down. It's interesting that if you look at representing this data in this particular sparse voxel octree format it winds up even being a more efficient way to store the 2D data as well as the 3D geometry data, because you don't have packing and bordering issues. So we have incredibly high numbers; billions of triangles of data that you store in a very efficient manner. Now what is different about this versus a conventional ray tracing architecture is that it is a specialized data structure that you can ray trace into quite efficiently and that data structure

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brings you some significant benefits that you wouldn't get from a triangular structure. It would be 50 or 100 times more data if you stored it out in a triangular mesh, which you couldn't actually do in practice.

I've been pitching this idea to both NVIDIA and Intel and just everybody about directions as we look toward next generation technologies. But this is one of those aspects where changing the paradigm of rendering from rasterization based approach to a ray casting approach or any other approach is not out of the question but I do think that the direction that Intel is going about it as a conventional ray tracer is unlikely to win out. While you could start doing some real time things that look interesting its always going to be a matter of a quarter the efficiency or a 10th of the efficiency or something like that. Intel of course hopes that they can win by having 4x the raw processing power on their Larrabee versus a conventional GPU, and as we look towards future generations that's one aspect of how the battle may shape up. Intel has always had process advantage over the GPU vendors and if they are able to have an architecture that has 3-4x the clock rate of the traditional GPU architectures they may be able to soak the significant software architecture deficit by clubbing it with processing power.

From the developers stand point there are pros and cons to that. We could certainly do interesting things with either direction. But literally just last week I was doing a little bit of research work on these things. The direction that everybody is looking at for next generation, both console and eventual graphics card stuff, is a "sea of processors" model, typified by Larrabee or enhanced CUDA and things like that, and everybody is sort of waving their hands and talking about "oh we'll do wonderful things with all this" but there is very little in the way of real proof-of-concept work going on. There's no one showing the demo of like, here this is what games are going to look like on the next generation when we have 10x more processing power - nothing compelling has actually been demonstrated and everyone is busy making these multi-billion dollar decisions about what things are going to be like 5 years from now in the gaming world. I have a direction in mind with this but until everybody can actually make movies of what this is going to be like at subscale speeds, it's distressing to me that there is so much effort going on without anybody showing exactly what the prize is that all of this is going to give

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us.

Ryan Shrout: So, because Intel's current demonstrations are using technology from two previous generations rather than showing off one or two generations AHEAD of today, there is little exciting to be drawn from it?

John Carmack: I wouldn't say there's anything that Intel has shown, even if they network a whole room full of PCs and say "we'll be able to stick all of this on a graphics card for you in the coming generation," I don't think they've shown the win. I don't think they've shown something people will say "my god that's 10x cooler" or "that makes me want to buy a new console".

It is tough in a research environment to do that because so much of the content battle now is media rather than algorithms. They've certainly been hacking on the Quake code bases to at least give them something that is not an ivory tower toy, but they're working with something that is previous generation technology and trying to make it look like something that is going to a next-gen technology. You really can't stretch media over two generational gaps like that, so they're stuck. Which is why I'm hoping to be able to do my part and provide some proof of concept demo technology this year. We're working on our RAGE project and the id Tech 5 code base but I've been talking to all the relevant people about what we think might be going on and what our goals are for an id Tech 6 generation. Which may very well involve, I'm certainly hoping it involves, ray tracing in the "sparse voxel octree" because at least I think I can show a real win. I think I can show something that you don't see in current games today, or even in the current in-development worlds of unique surface detail. By following that out into the extra dimension of having complete geometric detail at that same density I think can provide something that justifies the technological sea change.

Ryan Shrout: How dramatic would a hardware change have to be to take advantage of the structures you are discussing here?

John Carmack: It's interesting in that the algorithms would be something that, it's almost unfortunate in the aspect that these algorithms would take great advantage of simpler bit-level operations in many cases and they would wind up being implemented on this 32-bit floating point operation-based hardware. Hardware designed specifically for sparse

voxel ray casting would be much smaller and simpler and faster than a general purpose solution but nobody in their right mind would want to make a bet like that and want to build specific hardware for technology that no one has developed content for. The idea would be that you have to have a general purpose solution that can approach all sorts of things and is at least capable of doing the algorithms necessary for this type of ray tracing operation at a decent speed. I think it's pretty clear that that's going to be there in the next generation. In fact, years and years ago I did an implementation of this with complete software based stuff and it was interesting; it was not competitive with what you could do with hardware, but it's likely that I'll be able to put something together this year probably using CUDA. If I can make something that renders a small window at a modest frame rate and we can run around some geometrically intricate sparse voxel octree world and make a 320x240 window at 10 fps and realize that on next-generation hardware that's optimized more for doing this we can go ahead and get 1080p 60 Hz on there.

That would be the justification that would make everybody sleep a whole lot of better that there is going to be some win coming out this.

Ryan Shrout: Is AMD's tessellation engine that they put in the R600 chips anywhere close to what you are looking for?

John Carmack: No, tessellation has been one of those things up there with procedural content generation where it's been five generations that we've been having people tell us it's going to be the next big thing and it never does turn out to be the case. I can go into long expositions about why that type of data amplification is not nearly as good as general data compression that gives you the data that you really want. But I don't think that's the world beater; I mean certainly you can do interesting things with displacement maps on top of conventional geometry with the tessellation engine, but you have lots of seaming problems and the editing architecture for it isn't nearly as obvious. What we want is something that you can carve up the world as continuously as you want without any respect to underlying geometry.

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27.2 Hybrid rendering, graphics APIs and mobile ray tracing

Ryan Shrout: Based on your new data structure method using ray tracing, could you couple this with current rasterization methods for hybrid rendering?

John Carmack: I saw the quote from Intel about making no sense for a hybrid approach, and I disagree with that. I think that if you had basically a routine that ray traces this area of the screen in the sparse voxel octree it's going to spit out fragments, it's going to wind up having a depth value on there that you could intermix with anything else. Even if you had a ray trace against a conventional architecture you would still want to have a fragment program there that would look almost exactly like current fragment programs that we've got right now. I couldn't imagine wanting to do something that didn't have a back end like that. I mean you might even have vertex processors - the stuff that Intel is doing right now, ray tracing into the geometry, it's very likely that you would in the end want to be able to run the triangles in there that you are ray tracing against through vertex and fragment processors and you're just getting the barycentric coordinate of your ray trace stab. You have to know what you hit but then you have to know what you want to do there. You would want in addition some ability to send dependent rays out from there as extra elements.

It's reasonably likely that if my little data structure direction pans out you'll probably still want to do characters as skinned and boned with traditional animation methods. While you could go ahead and work out a voxel method of characters using refraction skeletons around characters and you could do animation, you probably wouldn't want to because we can make characters that look pretty damn good with the existing stuff and if everything continues to get 10x faster without us doing anything you'll probably want to do characters conventionally. But if you can do the world and most of the static objects at this incredible level of detail that you would get with the sparse voxel octree approach that seems like a completely reasonable way to mix and match.

Now there are aspects that mix and matching would work poorly. It would be nice to be able to solve the shadowing problem really directly by ray

tracing. You could do that in a completely ray traced world, you just send the shadow rays out and jitter them and do all the nice things that let you solve the aliasing problem nicely. But if you rasterized characters traditionally with hardware skinning, the voxel ray tracer wouldn't find any intersections with the characters, and they wouldn't cast any shadows. So there are down sides to that but what I want to get out of ray tracing here is not a lot of what would be considered the traditional benefits of ray tracing: perfect shadows - shadowing would be damn nice to be solve but we can live without that - things like refraction and multiple mirror bounces. Those just aren't that important and we have every evidence in the world about that because in the real world where people make production renderings, even if they have almost infinite resources for movie budgets, very little of it is ray traced. There are spectacular off line ray tracers but even when you have production companies that have rooms and rooms of servers they choose not to use ray tracing very often because in the vast majority of cases it doesn't matter. It doesn't matter for what they are trying to do and it's not worth the extra cost. And that's going to stay fairly similar throughout the next-generation gaming hardware models.

What I really want to get out of the ray tracing is this infinite geometry which is more driven by the data structure that you have to use ray tracing to access, rather than the fact that you're bouncing these multiple rays around. I could do something next generation with this and I hope that it pans out that way - we may not have dependent rays at all it and may just use ray tracing to solve the geometry problem. Then you can also solve the aliasing problem by stocastically jittering all the sample centers which is something that I've been pushing to have integrated into current rasterization approaches. Its obvious how you do it in a ray tracing approach; you jitter all the samples and you have some dependent, refinement approach going on there.

I think that we can have huge benefits completely ignoring the traditional ray tracing demos of "look at these shiny reflective curved surfaces that make three bounces around and you can look up at yourself". That's neat but that's an artifact shader, something that you look at one 10th of 1% of the time in a game. And you can do a pretty damn good job of hacking that up just with a bunch environment map effects. It won't be right, but

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it will look cool, and that's all that really matters when you're looking at something like that. We are not doing light transport simulation here, we are doing something that is supposed to look good.

Ryan Shrout: So current generation consoles and PC graphics cards aren't going to be capable of running this new type of sparse voxel octree based technology? And do you think vendors adding in support for it for next-generation hardware would be sacrificing any speed or benefits to rasterization?

John Carmack: Right not at all. You could certainly do it (sparse voxel octree) but it's not going to be competitive. The number of pixels that you could generate with that would be less than a 10th of what you could do with a rasterization approach. But the hope would be that in the coming generation we might have the technology for it.

No matter who does what, the next generation is going to be really good as rasterization, that is a foregone conclusion. Intel is spending lots of effort to make sure Larrabee is a competitive rasterizer. And it's going to be ball park competitive, we'll see how things work out, but a factor of 2 plus or minus is most likely. But everything is going to be a good rasterizer. We should have enough general purpose computational ability to also be able to do some of these other novel architectures and while everybody thinks it's going to be great I have to reiterate that nobody has actually shown exactly how it's going to be great. I have my ideas and I'm sure other people have their ideas but it's completely possible that the next generation of high end graphics is just going to be rasterizing like we do today with a little more flexibility and 10x the speed.

Ryan Shrout: Do you think DirectX or OpenGL will have to be modified for this?

John Carmack: They are almost irrelevant in a general purpose computation environment. They are clearly rasterization based APIs with their heritage but there is a lot of heard room left in the programming we can do with this. Almost any problem that you ask for can be decomposed into these data parallel sorts of approaches and it's not like we're capping out what we can do with rasterization based graphics. But when you get these general purpose computing things going, they will look like different environments for how you would program things. It could look like

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CUDA or with Larrabee you could just program them as a bunch of different computers with SIMD units.

Ryan Shrout: Intel has discussed the benefit of ray tracing's ability to scale with the hardware when they showed off the Q4: Ray Traced engine on a UMPC recently. What are your thoughts on that possible advantage?

John Carmack: Speaking as someone that is a mobile developer and a high end console developer, that's a ridiculous argument.

Ryan Shrout: Rasterization can scale just as easily?

John Carmack: Yeah. The idea of moving ray tracing onto the mobile platforms makes no sense at all.

Ryan Shrout: What are your thoughts on Intel's purchase of Havok and Project Offset? One theory is that Intel is going to be making a game engine either for demos or to sell. Do you think this is their hope in addressing the ability to "show a win" as you mentioned before?

John Carmack: That's what they have to do, that's always been my argument to Intel and to a lesser degree the other companies. The best way to evangelize your technology is to show somebody something. To show an existence proof for it, to kind of eat your own dog food, in terms of working with everything. Instead of just telling everyone you should be able to do great things with this, the right thing to do is for them to produce something that is spectacular and then say "ok everybody that wants this here's the code". That's the best way to lead anybody; it's by example. They'll learn the pros and cons of everything directly there and I very much endorse that direction for them.

27.3   Multi-GPU graphics and Conclusions

Ryan Shrout: What are your thoughts on the current climate of multi-GPU systems? Do you see that as a real benefit and do you think developers are able to take advantage of those kind of hardware configurations easily enough?

John Carmack: From a developer stand point the uncomfortable truth is that the console capabilities really dominate the development decisions today. If you look at current titles and how they've done on the console, you know, high end action GPU based things, the consoles are so the dominate factor that it's difficult to set things up so that you can do much to leverage the really extreme high end desktop settings. Traditionally you get more resolution, where a console game might be designed for 720p and the high end PC you go ahead and run at 1080p or even higher resolution, that's an obvious thing. You crank up the resolution. You turn off compression when you have 1GB of video memory available. And also normally you can go from a 30 Hz console game to a 60 Hz PC game. So there are a number of things you can crank up there on the PC, but it's difficult to try and justify any radically different algorithm, something you would really do with 4x the power you'd have with a high end PC system.

Ryan Shrout: Do you think NVIDIA and AMD are relying too heavily on the multi-GPU technology instead of pushing forward with true next-generation GPUs? Will multi-GPU systems continue to be an option at all?

John Carmack: I've always been a big proponent of these high end boutique systems - way back from the early days of 3dfx I always thought it was a real feather in their cap early on that they could pay more money and have a bigger system and have it double up and just go faster. I think it's a really good option and certainly companies like NVIDIA and AMD are throwing all the resources they possible can at making the newer, next-generation cards. But to be able to have this ability to just pay more money and get more performance out of a current generation is really useful thing to have. Whether it makes sense for gaming to have these thousand dollar graphics cards is quite debatable but it's really good for developers; to be able to target something high end that's going to come out three years from now by being able to pay more money today for 2x more power. Certainly the whole high end simulation business has benefited a lot from commoditization of scalable graphics.

Although on the down side it was clear that years back when everything was going in a fairly simple algorithmic approach as far as graphics engines where you just rendered to your frame buffer, it was easy for them

to go ahead and chunk that frame buffer up into an arbitrary number of pieces. But now there is much more tight coupling between the graphics render and the GPUs where there are all sorts of feedbacks, rendering to sub buffers, going back and forth, getting dependent conditional query results, and it makes it a lot harder to just chunk the problem up like that. But that's the whole tale of multi-processing since the very beginning; we're fighting that with multiple CPUs. It's the primary issue with advancing performance in computing.

That is my big take away message for a lot of people about the upcoming generation of general purpose computation on GPUs; a lot of people don't seem to really appreciate how the vertex fragment rasterization approach to computer graphics has been unquestionably the most successful multi-processing solution ever. If you look back over 40 years of research and what people have done on trying to use multiple processors to solve problems, the fact that we can do so much so easily with the vertex fragment model, it's a real testament to its value. A lot of people just think "oh of course I want more flexibility I'd love to have multiple CPUs doing all these different things" and there's a lot of people that don't really appreciate what the suffering is going to be like as we move through that; and that's certainly going on right now as software tries to move things over, and it's not "oh just thread your application". Anyone that says that is basically an idiot, not appreciating the problems. There are depths of subtly to all of this where it's been an ivory tower research project since the very beginning and it's by no means solved.

Ryan Shrout: NVIDIA and AMD driver teams have to hack up games to get them to work optimally on multi-GPU systems and that's more difficult for them today than in the past. Do you think developers dependence on the console market, which is solely single-GPU today, is a cause of those headaches?

John Carmack: It's probably making it even harder for the PC card guys because as developers get more sophisticated with the low level access we get on the consoles, the rendering engines are become harder to kind of, behind our backs, automatically split across multiple GPUs. We are doing more sophisticated things on the single GPU - there is a lot more data transfer going back and forth, updated states that have to be replicated across multiple GPUs, dependent sections of the screen doing dif-

ferent things. It's still possible buts it's kind of a hairy job and I definitely don't envy those driver writers or their task at all.

Ryan Shrout: Any thoughts on the 3-4 GPU systems from AMD and NVIDIA? Overkill?

John Carmack: For many applications, for the class of apps that just treat something like a dumb frame buffer, they really will go ahead and be 4x faster especially if you're just trying to be 4x the resolution on there, that's easy. There is no doubt that if you take a game that's playing at the frame rate you want at a certain resolution, a 4 GPU solution will usually be able to go ahead and render 4x the pixels, or very close to linear scaling.

But as far as what it's unlikely to do is take a game that's running 20 FPS at a given nominal resolution and then make that game run 60 FPS. You're likely bound up for things that aren't raw GPU throughput, usually CPU throughput in the game.

Ryan Shrout: You've had choice words for what AGEIA was trying to do with the hardware physics add-in cards. Now that they are off the scene, having been purchased by NVIDIA, what are your thoughts on that past situation?

John Carmack: That was one of those things where it was a stupid plan from the start and I really hope NVIDIA didn't pay too much because I found the whole thing disingenuous. Many people from the very beginning said their entire business strategy was to be acquired because it should have been obvious to everybody that the market for an add-in physics card was just not there. And the market proved not to be there. The whole thing about setting up a company and essentially lying to consumers, that this is a good idea, in order to cash out and be bought out by a big company, I saw the whole thing as pretty distasteful. It's obvious, and we knew when AGEIA was starting, that a few generations down the road we would have these general purpose compute resources on the GPU. And what we have right now are things like CUDA that you can implement physics on; you can't mix and match it very well right now, with such a heavy weight systems change, but that's going to be getting better in future revisions. And eventually you will be using a common set of resources that can run general data parallel stuff versus very high efficiency rasterization work. As for the PhysX hardware, while they would have a

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little bit of talk about how their architecture was somehow much better suited for physics processing, and it might have been somewhat better suited, for it they never told anyone how or why.

Ryan Shrout: Do you think moving physics to a GPU is a benefit?

John Carmack: Right now, to offload tasks like that you have to be able to go ahead and stick them in a pretty deep pipeline so it doesn't fit the way people do physics modeling in their games very well right now. But as people choose to either change their architecture to allow a frame of latency in the reports of collision detection in physics or we get much finer grain parallelization where you don't have this really long latency and you can kind of force an immediate mode call to GPU operations, then we start using that just the way we do SSE instructions or something in our current code base. Then, yeah, we definitely will wind up using compute resources for things like that or collision detection physics.

Ryan Shrout: NVIDIA has Novodex, Intel has Havok – will that cause fragmentation in the market? Do you think Microsoft would combine them into a physics API like they did DirectX?

John Carmack: It will be interesting to see how that plays out because while I was well known for having certain issues with Microsoft on the graphics API side of things I really think Microsoft did the industry a good favor by eventually getting to the DX9 class of stuff, having a very intelligent standard that everyone was forced to abide by. And it was a good thing. But of course I have worries as we look towards this general compute topic, because if MS took 9 tries to get it right...well. They probably have some accumulated wisdom about that whole process now, but there is always a chance for MS to sort of overstep their actual experience and lay down a standard that's no good. T heirstandards almost always evolve into something good... it would be wonderful if they got it right on the first step of DX compute, or whatever its going be. I wouldn't hold my breath on that because really all of this it is still research. With graphics we were really, for a larger part, following the SGI model for a long time and that gave the industry a real leg up. Right now this comes back to the earlier point: everybody's still waving their hands about what wonderful stuff we're going to do here but we really don't have the examples let alone the applications. So it's sort of a dangerous time to go in and start

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making specific standards when there's not actually all that much of an experience base.

As far as the physics APIs, I do expect that for any API to wind up getting broad game developer support, whether it's going to Novodex or Havok, they are going to have to have backends that at least function using any acceleration technology available. It'll just be a matter of Intel obviously not trying to make a CUDA implementation very fast but someone will wind up having a CUDA implementation for it that is at least plug compatible. Maybe NVIDIA will end up having wrappers for their APIs to do that. But that is just kind of the reality with today's development; unless you are a Microsoft tech developer or something that's tied to the Xbox 360 platform, developers aren't going to make a choice where "well we're going to use Intel's stuff and not run on the current console generation" or something. That's just not going to happen.

Chapter 28

Carmack frees Quake

This interview was conducted by Norman Chan for PC Gamer US on Jun 24, 2008.

Interview

Norman Chan: What inspired you to resurrect Quake III Arena as Quake Live?

John Carmack: At the very highest level, Quake Live - what we originally called Quake Zero - was one of my experiments about what we could do usefully on the PC platform. The consoles are very good machines for a lot of things, but there are some things the PC platform uniquely does better, such as anything having to do with a web browser and the superior mouse & keyboard interface. [Those things are] pretty darn good reasons to be playing on the PC, and were also trying out an innovative business strategy that could pave the way for the future.

Its completely free - there arent any micro-transactions. Quake Live is completely ad-supported on the web browser pages and [through] in-game advertising. Of course, this is speculative - were going to have to

see how this works out. Early on, we were tossing around two different orders of magnitudes - anywhere from 50,000 to 5 million people playing. We have no idea where it is going to be in there. The fact that 70,000 people have signed up in a week means that were going to be looking at hundreds of thousands of players, if not millions. We hope that that can be a sustained critical mass of a community that can play this type of game, and be self-supporting.

Quake III Arena was always my personal favorite id Software game. Its such a pure activity kind of game - more of a sport than a movie. And Im excited to have this opportunity to bring back the pure type of gaming as opposed to the everything and the kitchen sink modern design. We have no pretensions about it being the best multiplayer game in all types of things, but for any player looking to test their [deathmatch] skill, I think Quake III Arena is the best there ever was.

Norman Chan: Why this new direction?

John Carmack: I would say that there is this sense of trying to figure out what to do with PC gaming. Historically, id Software has been a PC gaming company, with consoles a secondary business that happened later. And even though the PC doesnt get the focus that it used to, in many ways our hearts are still there, and wed like to do things where the PC is the appropriate platform. [Wed like to] do something that really speaks to the future of where the PC can be superior to consoles.

Obviously, we have examples like World of Warcraft that show how the PC can be viable and vibrant in its own way. But in terms of first-person shooters, if you look at something like Crysis and say thats the height of what the PC market can manage, I dont think thats necessarily that exciting of a direction for the PC to be going in the future. With Quake Live, we hope that theres an opportunity for people whove never played shooters to give this a try, and with that, the potential of actually growing the PC gaming market. I still have a lot of a faith in simple gameplay formulas - it might not be the game that everyone plays for three hours a day to be the best at, but its something that offices, dorms, and schools across America can have fun with.

Norman Chan: How much of the original game has been ported?

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John Carmack: Every single level of the original game has been touched to bring them up to modern quality standards. All the little things, like level alignment and lighting in different areas. We also integrated in-game billboards throughout the levels. So, all the levels are modernized a little bit, but theres no pretense about this being a modern technology game. One of the key benefits of this, with the old game being a standard graphics benchmark, is that this is going to run on almost any machine youd want to play it on, and at a very high framerate.

Playing directly inside a browser window is moderately new in that it integrates friends lists and messaging. The core of the game remains the same.

Norman Chan: How will matchmaking work?

John Carmack: Increasing the approachability of the game is one of the absolute top-level priorities here. If someone bought Quake III right now and found a game online, they would have a miserable experience because people playing the game right now are too skilled and experienced. Were doing a few things to address that. Skill-based matchmaking is extremely important, so when you jump in, youre going to be someplace appropriate. But were also adding things like bot-guided training levels offline. When you initially set up your account, you get to give the system an indication of what your skill level is. After a few matches, the game will see how youre performing and adjust your choices.

Norman Chan: Whats going to convince the existing Quake III community to make the move to Quake Live?

John Carmack: Thats not necessarily our primary objective. We know that theres going to be some pushback. At least initially, were not going to have all the mods that they expect to have supported. But I do expect that a lot of people will transition because its going to be a more polished experience and its going to be a much larger stage to play on. If youre a hotshot player, youre going to want to know where you rank globally in the new community. But our top priority is to get a broader range of people - more than those who played the old game - trying this out.

If we have a breakout success, there are all sorts of places it could lead. But while this is novel and a new direction, I dont think this is that risky

of a bet for us. I have pretty high confidence on it right now.

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Chapter 29

Quake Live: Frantic and Free

This interview was conducted by Sal 'Sluggo' Accardo for GameSpy on Jul 11, 2008.

Interview

Prologue

GameSpy's ties to the Quake franchise go back pretty far, starting with the release of the QSpy server browser over 10 years ago. PlanetQuake served as home to countless mods as the franchise grew, and here in the office, games were played nightly for years. In Quake III's heyday, it was a regular occurrence for someone to yell "INSTAGIB" into the intercom at 5 p.m., and a local server would fill up instantly.

So it's not without some excitement and interest that we're watching one of id Software's latest projects: Quake Live. Originally dubbed "Quake Zero" when announced at QuakeCon last year, the concept is to make Quake III playable in a web browser, where it'll run on almost any PC in a matter of seconds and be completely free to play, through the use of

advertising. With E3 just a few days away, we chatted with id Software's John Carmack and Marty Stratton, who filled us in on the state of the project and what we can expect from it.

Questions

Sal 'Sluggo' Accardo: It's been a while since we last talked about Quake Live; can you give us a quick overview of the game and where it's at now?

John Carmack: What we've done is taken the Quake III Arena game that we released nine years ago, but still has tens of thousands of people playing online on a regular basis, we've taken the core of the game, stripped out all the antiquated user interface stuff, and wrapped it in a web browser interface, so that all the things you used to do with configuration, and especially finding a game to play and dealing with updates, are all handled by a modern web interface.

The game itself, once you get inside it, is not drastically changed from the original, although it's been brought up to a modern level of quality without changing the core rendering engine in any particular way. But what you do is, you go to the website, it's just a couple of clicks, it automatically happens, it brings the game down, you don't have to go off and install anything, update any drivers, this kind of stuff, you click on it, just like you would a Java or Flash game, but it is actually a full native game that was state-of-the-art AAA when it was released with a full development team going at it rather than a more amateur small-time development system on there.

Once you're into the system on there, it has all the things that you would expect from a social community thing: friends list, forums, matchmaking, teams, different things that you can set up there, an incredible amount of stats that are tracked on things. It's got leaderboards, and you can go back and scout how certain people have done in previous games; you can look at your ratios versus other people; and dig down as deep as you want in all of these kinds of baseball-like statistics on everything.

What we've done is take a game that was fundamentally good at its core,

cleaned it up a little bit, and wrapped it in an absolutely modern 2008 state-of-the-art kind of web experience that guides the player through it. We've taken, in the nine years that it's been sort of playtested with people, we've incorporated a lot of the small changes that the hardcore pro players like – minor things like weapon tuning and air control and anti-lag, different things like that – but most of the effort has gone into making this an experience that anybody who's never even played the game can just follow a few clicks, someone could give them a URL, go there, poke around, and be handheld through the early parts of the game and get in and start playing with people of similar skill level.

If we gave you a boxed copy of Quake III Arena today, you could install it and if you tried to go online and play, you'd have to find whole sets of patches to download, mods to get, servers to go to, find a group of people who haven't been playing for nine years straight and are a hundred times better than you – that's not a real viable experience. Everything we're setting up on the Quake Live project allows anyone, from anywhere, to get into the game quickly and easily with no hassle on their part and start taking, what we think were good about the original game and removing all the things that weren't great or were obstructions to enjoying it, and wrapping it up in what's good about the modern web experience.

Sal 'Sluggo' Accardo: Will Quake Live play out fullscreen, or just confined to a window in your browser?

John Carmack: It launches in the browser – it's a native plug-in – but it goes fullscreen. Because this is such an old title, and was used as a graphics benchmark for so long, on any reasonable system it runs at 120Hz. So when you go fullscreen, it looks at your desktop settings, and does drop down to 640x480 like the old game used to do. If you're running at a 2 megapixel display, it's running at 2 megapixels and it still runs really great, which is kind of an interesting thing relative to all the modern games including the things that we do that are leaning so heavily on the graphics card. This one does very much cruise on any computer you've bought in years.

Sal 'Sluggo' Accardo: In terms of content, will this be a full conversion of everything in Quake III, or just some of the maps?

John Carmack: It's everything that was in Quake III Arena, and also the

content from Team Arena, which a lot of people hadn't seen because it was an add-on expansion.

Every map has been touched, where it's not just maps copied over, but we took current level designers, and had them go through every single map. Everything has been touched up – the lighting's been improved, texture alignments, all these little things. When Quake III Arena came out, it was the first major hardware acceleration-required game, and it kind of got by on a lot of "wow, this is fast, colorful, anti-aliased graphics acceleration" stuff, and when we went back to look at it with a critical eye, we see a lot of things like "oh, these textures don't match along the walls, this area is too dark." All that type of stuff has been cleaned up as they integrated the sponsorship billboards, scoreboards and things like that inside the game.

Fundamentally, no changes have been made to the graphics engine, other than minor stuff about focus capture and full-screen modification and things like that. But the media has been touched in every case, the models have been tweaked, there are some new model skins, but the core content is basically in the style of the original Quake III Arena, just polished up a lot.

Marty Stratton: There are a couple of new maps, too. We have a young level designer that created a duel map that's really popular with our beta testers; a lot of pros really like it. We've created a couple of maps that are similar to existing Quake III arenas, but are different enough that they're pretty new experiences. So we'll go out the door with over 30 arenas and the full line of Quake III Arena characters.

We've added bright skins to a number of the characters, as well as what we call team skins. They're more green and white. Bright, but not full-bright. We've also done what some of the more advanced players wanted – pro-looking bright skins that are more of a solid bright color. And then when you see the opening of the game, you'll meet a new version of Crash who shows you around. She's our Quake Live version of Crash; she was reskinned to look like what the final website will look like (not what you'll see in the beta). The final website has a very ESPN-ish sports vibe to it.

John Carmack: The project did get more ambitious over the last year. We announced it at QuakeCon last year, which was shortly after we had the original idea, at that point, we were sort of thinking, we're going to take

Quake III Arena, strip out some stuff and wrap a website around it, and we'll do it in six months. Of course, here we are, almost a year later, and it's just rolling into beta.

Some of that was underestimation on our part, where we did underestimate the task of doing a modern website with a database backend and some of the server management issues, but some of this was also that we went out and made the game better than we originally planned to. More effort did get put on all the different media, more effort went into the testing – it's been running in beta, for how long now?

Marty Stratton: It's been about four to five months now. Now we're at the point where we're adding about 1500 players per week, and once we get moved over – we're hosting that back end here at id, and our IT manager is starting to get grumbly about the amount of bandwidth we're taking, so we're in the process of making a final decision on our data center – we'll actually start adding 10,000 people per week or more, going through more of an open beta through July, through August, growing it up to 150,000-200,000 people, making sure that when we remove the gate from the site, that we have a solid experience that can support a huge number of people hammering the site.

Sal 'Sluggo' Accardo: On the mapping side, is there any chance we'll see a remake of [Quake II map] "The Edge" in Quake Live?

Marty Stratton: It's like you're downstairs with us! (laughs) We're talking about it; I don't think we'll have it for launch, but we've already started to experiment with some stuff.

John Carmack: One of the great things about this is because the content is streamed through the web interface, it's all set up so that we'll be adding stuff continuously. As long as the market can support the product, we'll have people on it creating new things and managing the experience there.

And that's the big open question. This is a very speculative experiment, and at the beginning, we really had no clue how many people might be interested in this. Reasonable arguments could be made for anything from 50,000 to 5,000,000 potential users. There was certainly a fear early on that we might spend, even if we were thinking six months at the time,

we'd go out and open it up and there'd be crickets chirping – you'd have 50,000 people that sign up and you get only a few hundred people on at any given time. At least that fear has been allayed by the fact that we've had over 100,000 people sign up for our beta with no promotion and really no way to get in and take a look at it right now.

So we're leaning more towards the high end, so now we do have some fear about, well, if we do have some hiccups with several thousand people, what happens when we have five million people? You don't want to have the experience where people say "hey, go take a look at this" and people go and say "oh, it crashed."

Sal 'Sluggo' Accardo: Will Quake Live also include bots for people who want to get in and practice on their own?

Marty Stratton: Yes, there are bots. Our interface for joining a game is divided between two tabs. One shows you online games, presented as thumbnails where you can filter out games – they'll always be presented with the best quality in mind, games happening at your skill level, with the lowest ping, and if you have friends in those games, they'll bubble up to the top, and you can narrow your search by all the different factors – friends, or just free-for-all, those types of things.

And then you can go and practice against all of the bots in any of the arenas. John Dean, who's kind of our resident AI programmer, spent some time and added some functionality to the bots, where they actually dynamically scale their skill based on your skill. That's actually how we do the initial warmup match: We have a bot that scales their skill to you, and then we set your initial skill ranking based on that. But then you can go in and play against those same bots and choose the setting that says "keep it close" and the bot will adjust based on how well you do. Believe me, he's tuned them up a little bit where they can just hammer you.

John Carmack: The bots are one of the few areas inside the game where some programming resources have been expended. We hired John Dean for Enemy Territory development work, and he has done some really useful work on this project.

Sal 'Sluggo' Accardo: As far as community aspects like a friends list, are you looking to build a closed system, or are you looking to tie into any

existing systems like AIM or Steam, etc.

Marty Stratton: It's a closed system, but it's built on a Jabber network from a chat perspective, so if you have a Jabber client, we have the ability to allow you to chat between your Quake Live account and your Jabber client.

There's a friends list built into the website, and if you choose to play within the web browser window, there are three resolutions you can use based on your screen size, and your chat window stays persistent to the right side of your game window, so you can see the presence of your friends logging in. You'll get messages in-game when they log into the site; if they join your game, you'll see that. If they're on the website and send you a chat message, you'll get that chat message in-game and vice versa. So it's a very interwoven experience, and it's one of the areas that, as we progress the project, and if it's successful and we keep a team on it over six to eight months, will really be adding to that social aspect.

You go to QuakeCon and you've been part of the community a long time – you know that the social aspect of Quake III is as much as any other game. The way we've developed this website and the things we can do by centralizing all of this information and this experience really allows us to take new approaches but also existing approaches to that social experience and apply them into this game experience.

John Carmack: It is worth saying we don't have any intentions about becoming some kind of online gaming portal. The Quake Live system, it's Quake Live. We don't have any plans or pretentions about it being something more encompassing than that.

Sal 'Sluggo' Accardo: You mentioned stats, which have become more common in modern games. In that same vein, are there plans to add other features like achievements, which have proven popular in things like Call of Duty 4 or Team Fortress 2?

Marty Stratton: Achievements will be a big part if that's what drives you to play. We actually already have a list of 150 achievements: We'll probably pare that down to 30 or 40 for launch. For us, it's as easy as web development to create a new achievement, and adding that stuff to the back end is simple.

The idea is that we'll add achievements continually, and we can even have sponsored achievements. That really gets into how integrated the advertising partners are into the entire experience – not only can they have billboards in the game and ads on the website, but they can have sponsored skins, where, for the length of a campaign, you're playing with their skin. They can run contests, leaderboards, tournaments – that stuff is all integrated into this system; if you're playing in a tournament that's sponsored by X, they'll probably own all the advertising in the arenas that you're playing in. So it's really an interwoven way of approaching this stuff, far more extensive than just throwing an ad up on a wall. It really is a totally integrated way of doing things and unlockables totally will work. We actually plan to unlock quite a bit of content over the course of the project.

Sal 'Sluggo' Accardo: So, on that topic, can you go into a little more detail on how the advertising will work?

John Carmack: Inside the game, every level has been geometrically modified to have tastefully-done billboards and stuff in there. If you had a switch to turn off all the advertising, everything would look worse, because it's built around expecting to have those things in there. There's ads on the scoreboards when you die, there's all the traditional website advertisements and all the things Marty talked about in terms of sponsorship.

What's great about this is that it would be silly to try and integrate this into something like Doom or Rage, where in most cases, it would be damaging to the gameplay experience, but it totally fits within Quake III Arena, because it was always this sports-arena sort of thing, where you're playing a sport rather than progressing through a movie. It's not tastefully-done product placement – it's the billboards you would expect to see in an arena and we really haven't seen any negative feedback from the users. It's not something that's annoying and pushed in your face, like "click here and watch this ad for 30 seconds so you can play our game" – there's none of that going on.

Sal 'Sluggo' Accardo: Is there any ballpark release date set for Quake Live yet?

Marty Stratton: We're taking a baby-steps approach, releasing over a pe-

riod of time so we're not flipping a switch and getting hammered and the site goes down and nobody has a good experience. So the plan right now is we're sitting around 4000-4500 beta testers, we invite about 1500 a week, and as soon as we're moved to our managed hosting solution, we'll start to grow it by 10,000 players per week. As the infrastructure supports it, we'll make sure that we can grow the way we want to, but take a measured approach to it, upwards of 150,000-200,000 people before we remove the gate. That is planned to happen through July and into late August before we would kind of remove the front gate and open the site broadly.

John Carmack: The nice thing is that, unlike a packaged goods model, we don't have to have our two-week media blitz timed to when things hit the store shelves. We expect this to grow more by positive word of mouth, people passing it on, but we want it to be an easy enough thing so that you can just tell someone in a chatroom or email, just visit quakelive.com and follow the instructions and you really don't need to give them much more than that. We think it'll have significant growth through the first six months of development – we should know by the end of six months whether this whole thing is panning out or not.

Sal 'Sluggo' Accardo: Before we run out of time, can you describe the evolution of the project? Was someone just fooling around running Quake III in a browser, or was it a case where id was looking to dabble in the online space and Quake III was just the best fit?

John Carmack: There are a lot of things that led to it, but it was mostly me thinking about trying to do something on the PC that played to the PC's strengths, rather than treating it as an expensive console with driver problems. If you take a PC game like Call of Duty or something, it's not catering to the PC's strengths, it's using it as a different type of console.

Historically, at id Software, all the way up through Doom 3, we were a PC development house. We thought of consoles as an afterthought for us, and there really has been a sea change there, where our big titles, what we're doing with Rage and id Tech 5, are cross-platform, with consoles honestly being the more important brethren there. But there are still things the PC does better than the consoles: browsing the web, displaying a lot of information, the keyboard-mouse interface for first-person

shooter gameplay, the ubiquity of computers being everywhere and being able to access the same data sets from lots of different places.

It's never been a secret that Quake III Arena was my favorite game internally at id Software. It was a pure-play game, not necessarily as media-heavy and awesome in some ways as some of the other stuff we were doing, but I really liked that type of experience. And it doesn't look like that type of a pure-play experience can stand as a $50-60 AAA title now no matter what you do with it. I was recently looking at Unreal Tournament III, which is a damn fine game in many ways, but not a blockbuster saleswise. So the idea of being able to take the core of what's good on that, and try out a new business model on the PC has been pretty appealing.

And it also has secondary benefits. Even if it turns out to not be a business success, we've taken a new team of people and put them through the entire concept-design-develop-deploy-test-manage cycle in a relatively short time, and if we need to grow another team around them, or take them over as more senior people into a follow-up Doom project, we could certainly do that.

Obviously, I hope that this works out well as a business model, that we can be successful, that we can leave the team on Quake Live and they can continue to nurture and support it for years to come, but even if it doesn't, we think it's a good play, a worthy gamble that we're making.

And if we're successful, I bet there's going to be a lot of companies that go out wanting to take some old title and wrap a web interface around it, and most of them are going to find it's harder than it sounds, and most games aren't nearly as well-suited for it as Quake III Arena is.

CHAPTER 29. QUAKE LIVE: FRANTIC AND FREE

Chapter 30

id Software's John Carmack and Marty Stratton Talk Quake Live, PC Gaming, and More

This interview was conducted by Nick Breckon for Shacknews on Jul 13, 2008.

Interview

Prologue

Following the release of Doom 3, legendary developer id Software shuffled to the background of the gaming industry for a time. Now the company is readying for a resurgence, on several fronts at once.

id is readying two traditional big-budget titles in Doom 4 and Rage, the latter marking the company's first original IP in some time. Founded late last year, id Mobile will be releasing its first project later this year with Wolfenstein RPG, the follow-up to the Doom RPG. Finally, the company

is forging new ground in the web-based gaming sector with Quake Live, a free version of Quake III Arena without all the fuss–or the cost.

Recently I had a chance to talk with id Software co-founder John Carmack, as well as executive producer Marty Stratton. While the theme of the talk was Quake Live, we also covered topics ranging from the state of PC gaming to the potential of iPhone development.

Questions

Nick Breckon: I had a chance to check out the Quake Live beta last night, and more than the technology or the price point, the thing that impressed me the most was how easy it was to get started and jump into a game. I assume that was a primary goal in development?

John Carmack: Yes, and I'm so happy we're finally talking to somebody that's actually been on the beta and gone and looked at it so I don't have to explain everything from first principle.

But yeah, the idea is that we know that we had a good core gameplay experience there, but, for instance, if somebody was given a copy of Quake Arena right now and they wanted to go play the game and navigate online, they would have a wretched experience. Because we have people that have been playing the game for nine years online, and somebody who just gets the game for the first time and says, "Oh I'm gonna jump on here," there's no way they would have a decent experience.

But so much of what we're trying to do here is to make that possible. To have somebody who is not necessarily a first person shooter player, and would not go and spend 50 or 60 bucks on a brand new AAA title, or might not even own a console or something, but can just, from practically any computer in the country–if not the world–sit down, go to Quake Live, get the things on there, jump in, be led through a new style of play, and have everything catered around what they're capable of doing and what's going to be enjoyable for them.

So that's the hope. We're hoping that we get something that you could basically tell anybody, "Hey, go check this out, you might enjoy it." And

if they're willing to spend 20 minutes to go through and play through the basic match, and get a look at it, that they might say, "Hey, I do kind of like this style of game."

Nick Breckon: Do you see the future of PC game development becoming focused on that challenge of streamlining the user experience?

John Carmack: Yeah, I think that the PC definitely can't.. we can't go on making PC games like we used to. The combination of the dominance of the consoles, as far as market forces there, and piracy.. the traditional AAA, media-heavy boxed game that sells for a bunch of money, and goes out on the PC for a single player experience–it's just not happening. Even if we look at something that had such a push like Crysis, it didn't really do all that well.

While at id Software we're still certainly doing those types of AAA titles on [the PC platform], we have to look at it from a cross-platform product perspective on there, rather than being PC-focused like we used to be. I mean, all the way up to our last major title, which was Doom 3, we were a PC company. We made PC games, and we gave some thought to how they might be deployed on consoles, but that wasn't what we were fundamentally doing. And that has changed with this generation.

But still, there are some things that the PC does fundamentally better than the console. I mean, the internet interaction, as far as displaying and navigating large amounts of information on a website–while you have web browsers on consoles, they suck, you know, they're just not good. It's not like what you've got on the PC.

And from a first person shooter perspective, the keyboard/mouse interface is still just a lot better than a console interface. It's a much more direct position vs. integrating over time.. it's just plain better, and that's one of the things we want to cater to.

So there are strengths that the PC has, and we think Quake Live is very much playing to them. While given infinite resources, yeah, it'd be great to go ahead and do another technology showcase on the PC, because you've got a couple times the power in a modern high-end system than you do in a current generation console.

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But it's just not feasible for us as a company to continue taking that route. So we are branching out into some different areas and diversifying a little bit, where we've got our id Tech 5, cross-platform, high-end stuff that we are pushing, and we've also got Quake Live and our mobile products.

Nick Breckon: Speaking of mobile products, the second generation iPhone launched today. What's going on at id Mobile?

John Carmack: I'm really kind of sad about.. how things played out outside of our real control on that. I'm really bullish on the iPhone market. I think that what they're doing with iTunes, cutting the carriers out of there.. it's a great hardware platform.

It's a market I really want to be in, we just didn't have the resources to go do something for the initial launch.

Robert Duffy and I actually hacked together a kind of a port of some of the Orcs & Elves stuff using the 3D engine, but we just didn't have the manpower to do something that would be what we would consider our best foot forward. We still have a lot of effort going on in the Java and BREW stuff. Wolfenstein RPG is gonna be coming out later this year, and that's really great in a lot of ways.

Nick Breckon: Does a 3G cellphone connection offer any advantage as far as online gaming?

John Carmack: Bandwidth is good with 3G, but latency is still worse than an old dialup connection. Of course with WiFi, it is as good as any other computer.

Nick Breckon: So would you say that id committed to developing an iPhone game?

John Carmack: I definitely want to, and we have some experiments running, but the main team is probably going on to a Doom RPG sequal for Java/BREW next. We have been trying to find someone to lead a dedicated iPhone project that we have been discussing.

Nick Breckon: Getting back to Quake Live–is the plan still for the game to be totally ad-supported?

John Carmack: We think that there may eventually be some kind of–I

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think that there will likely be some kind of premium subscription at some point, but we really don't know what it is. We don't know what we want to offer.

It would not be eliminating the ads, because the ads are actually–if you turned the ads off in the game, it would look worse. The game is so wrapped around this kind of ESPN-ish look and feel that if all of those turned into blank billboards, it would be a detraction from that experience rather than any kind of enhancement.

But there may be something just in terms of people wanting to separate themselves into tiers, or maybe adding some other stuff, but we really don't know, and we're definitely not rolling out with any kind of subscription-based stuff on there.

But it's not just in-game advertising that's supporting it, there are going to be a lot of specific sponsorship things as well. Sponsored levels, sponsored skins, sponsored tournaments, leaderboards and so on. We just don't know how this is going to play out business-wise. It's a big experiment for us. There aren't any real [comparable examples] for us to point to that are really close to what we're doing here.

We can certainly look at lots of successful things that go on on the web, with free content and various things that have done well. There are lots of casual games that are doing moderately well. But this is a new data point, and I'm sure a lot of people will be watching very closely to see how we do.

Nick Breckon: As far as capitalizing on the strengths of the PC, will you be planning any kind of community generated content or mod support?

John Carmack: Not initially. That's been one of the toughest questions that people have asked us from day one, is how we're going to be integrating all of that. It is a tough call I expect.

Marty Stratton: Yeah, it is. I mean, in making a system easier–and again, as John has said, this is kind of a test case for us, so we're solving these issues to some extent as we go–in making the system easier, it's required us to take control of a lot more things that we normally do. Taking control of servers, taking control of content, delivering that content–as you

probably went through the registration process, you downloaded maybe 180 megs of information basically without even knowing it, because it happened while you were playing your warm-up match. Those types of things require us to take control and somewhat close the system a little bit.

On some of the mod stuff, we've actually talked to the mod teams, particularly the competitive mod type stuff, who have maintained a community of people continuing to play the game nine years later. And we've incorporated a number of things that casual players won't know about. In fact, they're things that will actually make the experience a little bit better for players, but also things that experienced players will really appreciate: weapon tweaks, physics tweaks, networking tweaks, anti-lag stuff. Things that have been done in the mod community previously. We talked to those groups, and in some cases contracted those people to roll that stuff in on our site.

As far as content goes, it really is something that I want to bring in as we go forward, and as the product gets successful. My personal feeling is that it will come in more like user-generated content comes into, say, current social website communities. An idea would be like: we make our SDK available, we run a level design contest, a certain period of time passes, we take those levels, weed out the ones that basically aren't up to some level of quality, and then we put those up on the game, and they go out to everybody. So that again, we don't get that fractured community, where this person is running this mod, this person is running this map, and when you connect to the server it doesn't know that you have it–which is kind of the current state of the original Quake III.

But basically we push all this content to everybody, make it available to everybody, and then on the website we can enable people to either automatically, or by their own input, vote on this content, or put it up a ladder of quality or preference. And then either reward or award the people who created that content, or [reward them] just because it's up on the site and it's the most played map out of all of this user generated content, just like a Youtube video has a certain cache when your stuff rises to the top. I think that is probably the future of the way we're going to be able to deliver new content.

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And of course I say all that–that won't be what we do initially. What we're initially focusing on for our first release is getting this core experience, this technology all in place to create a great user experience. But I think down the road, as we do roll in that type of content, we're thinking of new ways to integrate it.

John Carmack: But it's worth remembering that Quake Arena is not going away. It's still there, and I can very much see millions of people making Quake Live as their entry into that, and then the mod community will probably have a huge boost from all of this. The people that want to do something different that's not [supported] in Quake Live, well they've still got Quake Arena. It's open sourced and they can do anything want in there, and build whatever new mods they want, and I would expect this to have a positive effect on that entire community on a lot of different levels.

Marty Stratton: And because the fundamental engine and really the game hasn't changed, we can actually take Quake III content, a Quake III map–not so much a full mod–but a Quake III map, and it basically comes into the game in a matter of minutes. It's very easy, so, you know, it could be something where it just reinvigorates the Quake III mod scene, and we can continue to take a look at that and bring stuff to market that makes sense.

Nick Breckon: It sounds like adding content to the game is relatively easy. How much of a challenge has the project been so far?

John Carmack: That's kind of an interesting thing where we announced this at QuakeCon last year, and we started putting our team together, and honestly, we underestimated some of the effort. The idea was, "Oh, we'll take this whole game that we've got, we'll wrap a weapon around it, and put it out and see what happens."

But when we started getting getting down to decisions and saying, we really want to do an absolutely top notch–the game's not state of the art, but the web interface around it really is. And we did not have the experience in website development, database management, and all of that web world type stuff. And honestly, we underestimated the challenge involved in that. So it has been a significant effort taking the game to this point, and I'm sure we're going to run into significant problems as we roll

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it out and scale it up.

There are challenges there that–it's not that we didn't think there would be any problems, but it's just that we're honestly ignorant of a lot of the challenges. And as far as how successful it is, we can just cross our fingers and hope. We're going to put something really good out there, but in the world of business and everything, sometimes you can have a great product that doesn't succeed. But we can do our side of it, and see what the market thinks of it. But I have some high hopes.

Marty Stratton: And you know, even to John's point, we did underestimate– it's become a much larger project. I think we still make the decisions that are going to make it the absolute best product of its kind–it's kind of a one-of-a-kind product, anyway. But a lot of stuff that we're developing right now and rolling out over the next couple of weeks you didn't see yet today when you joined the beta.

I mean the website even still is totally not–when we launch the new website here in about a week, it's completely different looking. It's really pretty dramatic. So we've taken these challenges, but we're still developing it fairly efficiently. We have a team of about eight guys internally and four contractors externally working on it, so still a relatively small team that's been able to put this together.

John Carmack: I would expect that if we are successful, there will be a lot of other people that say, "Hey, we've got games from nine years ago, let's do the same thing," and a lot of them will probably be surprised at how non-trivial it actually is. It's just one of those napkin ideas that you can lay out really quick, sounds really plausible, doesn't sound like too terribly much work, but they always are.

Nick Breckon: How involved are you in the development of Rage and Doom 4 right now, John?

John Carmack: Essentially all of my programming time is on Rage right now, and I will be talking a lot about Rage development at QuakeCon. I duck out for a few days at a time in "retreat mode" to work on mobile projects a couple times a year. Kevin Cloud is running the Doom project, and I won't be involved on a day to day basis with it, although Kevin does run the core decisions by me.

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Nick Breckon: Have there been any major developments with id Tech 5 since last year's reveal at QuakeCon?

John Carmack: None of the core decisions have changed, it is now just a lot closer to being a game.

Nick Breckon: Will you be speaking at this year's QuakeCon? And will there be any major announces from id?

John Carmack: We don't have any shocking news, but I will be giving my usual open discussion about all of our software development efforts and experiences on the different platforms.

Chapter 31

E3 '08: Carmack IDs Quake Live

This interview was conducted by Tom Magrino for GameSpot on Jul 13, 2008.

Interview

Prologue

It isn't at all unusual to hear the word's "pioneer" and "id Software" uttered within the space of a breath. After all, the Mesquite, Texas-based outfit dramatically revolutionized the gaming industry in 1993 with the ground-breaking first-person shooter Doom. Since then, the developer has maintained its position as a technological innovator, thanks in no small part to programming wunderkind John Carmack.

At last year's QuakeCon, the notable studio first teased its next ambitious effort in the gaming industry, announcing a free-to-play, ad-supported version of Quake III Arena. However, forgoing the traditional brick-and-mortar distribution channel, and outright leapfrogging the fledgling digital download market, id revealed the game would be streamed as a native

application through an everyday Web browser.

Nearly a year on and a partnership with in-game advertising kingpins IGA Worldwide later, id is preparing to open the flood gates on Quake-Live.com, the platform that will host the free-to-play, browser-based Quake III Arena. With id expecting to flip the switch on QuakeLive.com as soon as next month, GameSpot sat down with id Software founder and technical director John Carmack as well as executive producer Marty Stratton.

The gaming execs discussed what Quake Live brings to the table, how the ad-supported gaming fit in with id's mobile and top-tier development strategy, what PCs still have over consoles, and how the PC is the "junior partner" in id's cross-platform strategy for Rage and its latest-and-greatest game engine, Tech 5.

Questions

Tom Magrino: Quake Live was initially announced as Quake Zero at last year's QuakeCon, and you all said it would be an experiment in advertising-supported gaming. When did it become Quake Live, and what has been going on with the game since then?

John Carmack: So the process was, I had this rough idea to try this shortly before QuakeCon last year, and we announced it there, but we didn't wind up tying up all the domain names that we should have when we were calling it Quake Zero. So some speculators or squatters wound up sitting on the domain, and we decided that since it was still the early days, to go ahead and just change the title of the game, rather than pay them off.

And it's been Quake Live since very shortly after that. Now, it's definitely already been significantly longer than we thought it would take to launch. The initial thought was that this might be a six-month development, where we take the old title and we wrap a Web interface around it and kind of push it out there and see what it does. And it turned into, one, a more ambitious project, and two, as we should have expected going in, we really didn't know how to make Web sites and manage databases and all

that stuff with the people that we already had in house.

And there's been a big learning experience on it, and here we are, almost a year later, and it is rolling into beta now, and we're pretty happy with how it looks on everything. But the big question about how this will do as a business model should be answered within six months. We'll know whether things are playing out fairly early.

My first earliest fears have already been resolved where, when this idea was first floated out, we really didn't know if when we launched, if we would get 50,000, 500,000, or 5 million people playing it. I mean, I could see credible arguments that people could make for any of those numbers and anything in between. And I was really quite heartened when we opened the beta registration process and we have had over 100,000 people sign up, with really no significant promotion or anything around it.

I think that bodes very well for the possibility of getting in the multiple millions of regular users. And so much of the effort that's gone into this has been about turning it from something that was very much a hardcore game, into something that is approachable by everybody. We've taken all the suggestions that the people that have been playing the game for the last nine years–the diehard, competitive crowd–the things that they like about it, and the rule changes that they've liked, and so on. Those are all moved into the game.

So in many ways it's better for the hardcore people, but most of the focus has been on making sure that, if somebody–since it's free, you want the scenario to be, "Hey, go check this out. You might like it." We want people to be able to go to the Web site, and things just automatically happen. They jump in, they're trained a little bit, they're taught what goes on in the game. They're given an opportunity to play at something that won't be overwhelming, and then based on how their training match went, the initial games that they select to play in will be with people at a similar level of skill.

Because right now, if you gave somebody a boxed copy of Quake Arena, there's still a few thousand people playing it, like, probably at this moment still, online. So there's a community of tens of thousands of people that are still active Quake III players. But if somebody was given a copy

of Quake III, and they tried to go online, they'd have a miserable experience. Because everybody's playing some modified version of something, the communities are all tightly knit and everybody is extremely highly skilled, if they're still playing the game, and it would be a lousy entry point.

So we've made that our highest priority. We want it to be something that people that have never played this type of game before can follow their Web browser over here and things just happen and lead them into the game and that's a nice, easy way.

Tom Magrino: So is this just a port of Quake III Arena? Or have you added in additional features?

John Carmack: The core game has had very little changes to the engine. The idea was to wrap this really state-of-the-art–player interaction, score-boarding, leaderboards, chat forums–all this stuff, around a stable, consistent game. So there are some advantages to that, in that every computer that anybody is at all going to sit down on, and is connected to the Internet, can play Quake Arena well. You know, most of them run it at 120-something frames per second on there. There are no driver issues, because everybody used this game as a benchmark for five years before it was superseded by other things on there.

The data has actually been touched on every single level, though. While the core rendering engine has only modest tweaks on it, nothing particularly to improve what you really call rendering things. But every map has been touched where there's a level of polish that modern games have that, when we look back nine years ago, standards were a lot more lax. I mean, Quake Arena was the first mainstream, hardware-accelerated game, and it was much more about, "Wow, look at this. Isn't it cool?" And people weren't looking at all the details, like making sure the textures line up or the lighting is appropriate.

And we have had the designers make a path through every single level in the original Quake Arena, the Team Arena content, and there's a little bit of custom new stuff that goes on in here also. So everything is cleaned up, brought up to a modern level of polish, the billboards and advertising scoreboards are very nicely integrated. It's not a matter of just finding a bare spot of wall and throwing up two triangles that you can stream an

ad on to. They're actually built into the levels in a very stylish way, where you've got the boards with spotlights, lighting them up as things change. And all that's been done really nicely.

But, you know, 90 percent of the work on the project has been stuff that goes around the game–the Web site experience, the game rankings, all the stat-tracking and database management, and all of this stuff that really is better than probably any game, anywhere has done. We went out, we surveyed the landscape of what was available, what we could integrate, what we could take, and what we could improve.

And we make no claims or try to hide the fact that the core of the game is essentially nine year old technology. But everything around it is modern, 2008, state-of-the-art stuff.

Tom Magrino: What changes or what new technology has made it possible to get the Quake engine running in a Web browser?

John Carmack: Fundamentally, nothing. We are running the game as a native application. This isn't a Flash or Java game. I mean, it's always been interesting for years to watch people port various versions of Quake to Java and run in the sandbox. But this is the core game put inside, and you could do this back when Quake Arena was originally released. And, in fact, that was one of my–it didn't wind up turning out like this–but I had actually pitched the idea of doing all of our user interface in a Web browser back when we did the original game.

So there's nothing fundamental that makes it possible now, that wasn't possible before. It was just a choice to go do this now, rather than focusing on the conventional game models that we had previously had through Doom III. The PC market has dropped an important force relative to the console for our mainstream titles. So what we're doing, we take Tech 5 and Rage, and PC's still there, but it's a junior partner in the cross platform strategy.

And Quake Live was our attempt to look at what the PC still does really honestly better than the consoles, where you've got the rich Internet experience, the good Web browsing, the ability to show lots of statistics, the ability to have ubiquitous PC anywhere–you could sit down and log into your account from anywhere–and, importantly, mouse/keyboard inter-

face, which for a game like Quake III, makes the game a whole lot more enjoyable than a joypad ever could.

I wouldn't say that things like new game advertising and web interface are the future of PC gaming. That's a huge over reach for something that's so speculative right now. But thinking about those types of questions, and then building PC games around what differentiates the platform from consoles–that has guided a lot of our decisions about what we do here.

Tom Magrino: Are there any plans to turn QuakeLive.com into a full-fledged platform in the vein of something like Garage Games' InstantAction, where you've got several different titles on it? Where do you see the future of this browser-based gaming going for you guys?

John Carmack: Well, the future on this is that we hope it's a successful product and we keep team members on it indefinitely. We don't have a follow up plan. There was a little bit of talk about taking Enemy Territory: Quake Wars, and doing something similar with it. But there are no current plans for that, and if we did do that, it would just be a completely parallel experience. We think that that the Quake Live game is going to be its own Web site, and it's not going to be part of a platform where you have selective different options.

Certainly, the success of some of the casual gaming markets has been a good find for us. That there's success to be had there, but just the level of product that we're putting out–something that was, at one time, the stand-out commercial title–and it is a different level of development from what people are expecting from Web games.

Tom Magrino: So you mentioned that this is a free product and will be ad supported. How is that going to be integrated into the game?

John Carmack: Yeah, it won't be strictly ad support, in that we have in-game advertising, billboards and such inside the game. There are ads on the scoreboards and when you die, and certainly all the normal Web site advertising. But there's also a lot of opportunities for sponsorship of things. Sponsored contests, whether it's sponsored media level tournaments, leaderboards, all sorts of things like that.

And while we have a good guarantee already on the in-game advertising,

it's going to be a toss up to see–well, we're very interested in seeing how it plays out. There's still every chance in the world that this just fails. We don't have the existing proofs to point to and say, look, clearly this a successful model because there are five other companies doing it. We may well wind up being the pioneer with all the errors in our plan here.

But there's enough good signs that I'm at least guardedly hopeful that this is going to turn out to be an interesting business for us.

Tom Magrino: Do you think that this kind of ad-supported model will, in the near-future, take off to the point where games are essentially free, and you're making money by serving ads to a mass-market audience?

John Carmack: It doesn't really work that way for most games and, you know, that's why we would never consider doing something like a Doom Live, or something, where the core of the game is just not as compelling with commercials and ads stuffed in. That's why I've never been a big supporter of in-game advertising in any of our other titles. You know, we've looked at it, we've been approached by people about it for our titles for quite some time. Actually, all the way back to Quake I, if you can believe it.

But we've never chosen to do it because, for lots of games, it's just not a good fit. Like, Quake Arena was always about this kind of ESPN-like arena, where there's commercialized combat, and it just fits pretty naturally with that game. You know, as with almost anything, there are lots of viable and valid paths to take, and I think that it'd be nice if it turns out that this type of thing can be a small niche in the market. I would be shocked if it turned out to be a dominant platform for PC gaming going forward. It's not out of the question, but it's not what I would expect.

Tom Magrino: What about the mobile market?

John Carmack: Well, I'm a big believer in the mobile market. We've sold over two million units our mobile games, Doom RPG and Orcs and Elves, and we have Wolfenstein RPG coming out later this year, the latest and greatest 3D engine, all that kind of good stuff.

So yeah, those in fact are the three prongs of this strategy right now. We still have our top-of-the-line, triple A, cross-platform titles with what

we're doing with Rage and Tech 5, and we're following up with another Doom game after that. But then we've got Quake Live, as our PC-focused title, and then we have the mobile projects, with what we're doing on mobile.

Tom Magrino: Would it be possible to do something like Quake Live for mobile phones?

John Carmack: You know, I have this type of discussion a lot with my wife, and the problem is that there's not enough tight control. You can't do a great action game on mobile right now in any kind of a broad base. I have really high hopes for the iPhone as a market. I think that what they're doing with the iTunes delivery, cutting the carriers out, native programming, graphic accelerator–they have lots of great possibilities there.

Although, fundamentally, unless you have Wi-Fi access, even the 3G network really fights for latency, so a Quake Live game would not be a particularly good product. All of the success of our mobile games is largely due to the fact that we didn't fight the platform. We built a completely new style of gameplay to cater to that. Rather than just saying, "Well, we know how to do first-person shooters, let's push one on the phones." Instead we've got the kind of RPG 3D stuff that we've been doing on there.

So no, I wouldn't expect a Quake Live on the phone anytime soon.

Tom Magrino: Alright. So do you guys have an expected launch date for QuakeLive on PCs?

Marty Stratton: We're rolling through a closed beta right now, and as John mentioned, scalability is something that we're cautious of. We don't have a lot of experience with the data-hosting side, and we're trying to get good solutions in place. So we're basically going to take a measured launch approach, where we move through our closed beta, where we're adding–right now we're adding about anywhere between 1,000 and 1,500 players a week to our closed beta. Over the next two, three weeks, four weeks, once we get into our data center, that'll allow us to then scale by tens of thousands every week. And I would expect us to grow that up to 150,000 to 200,000 through July and into August, and kind of see how the scalings happen.

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The last thing we want to do is just flip a switch, open the site, and be down within 30 minutes. I think even Apple is experiencing that [with the launch of its new iPhone]. I've heard you [couldn't] register your new iPhone because their servers are down. We've got a lot less experience than Apple does, so we're really trying to take an approach that'll allow large groups of people to get into the game, over a period of time. And then once we're confident we can handle all the loads, then we'll basically just take the gate off the site and open that up to everybody.

And that process will happen really through July, into August, probably later into August, and hopefully by then we'll be really near completely launched, if not completely launched. But, of course, that's one of the great things about this model. It's not like the boxed-good model, where you have to have your two-week media blitz leading up to the roll out on here. The product's going to sit there, and it can grow users at whatever rate it turns out to happen.

Once we're sure that the product really is solid, and we've got a happy user base, then we probably will be investigating in advertising and extra pushes and things like that, that we can do at it. But there's no real pressure for that to happen sooner rather than later. We'd rather let it grow at a cautious rate and try and do a great job, rather than make some big blitz and fall on our face because, you know, we weren't really qualified to deal with all those problems immediately.

And even from just a feature perspective, our focus is on I'd say maybe five core features that we're delivering over that time period that I just went through. Almost all of those are about the Web experience and the usability of the Web site and getting into the game. Longer term, we already have a list of I think it's eight to 10 features right now, that we want to add, and because the interface is on the Web, because the delivery mechanism is basically transparent, we can update content without people even really knowing. We can publicize things that basically are just as easy as updating a Web site.

So it really gives us a level of flexibility and speed that we've never had before with a retail product. I mean, we're not going through a publisher, so if we want to run a contest, we run a contest, and it's immediately up on the Web site. And the players see it, and if we need to push new content to

do that, we push new content to do it. It's really a whole different way of doing things for us, even from a development and delivery perspective.

Chapter 32

E3 2008: The John Carmack Interview

This interview was conducted by Will Smith for Maximum PC on Jul 15, 2008.

http://www.maximumpc.com/article/features/e3_2008_the_john_carmack_interview_rage_id_tech_6_doom_4_details_and_more

Interview

Prologue

We had an opportunity to speak with id co-founder John Carmack after the big EA press conference yesterday (where id surprisingly announced a partnership with EA to publish Rage). We grilled the legendary game developer (and part-time rocket scientist) about id's post-apocalyptic shooter, the state of gaming graphics, and what his plans are after id Tech 5. Rage looks be a drastic departure from the traditional id FPS, not only in gameplay style (open worlds with vehicles vs. claustrophobic indoor environments) but also in the way Carmack has designed the code-base. id has

already announced that Doom 4 is in development (no publisher has yet been annonced), and Carmack confirmed that it'll run at 30Hz and run with several times the graphics power as Rage, a 60Hz game.

Questions

Will Smith: Can you lead off by telling us a little bit about Rage and id Tech 5?

John Carmack: id Tech 5 is the next major technology generation after the Doom 3 [engine]. Doom 3 was targeted at high-end PCs and the original Xbox. Its been one of our big learning experiences working with our partner companies about just how miserable the porting process is. Doing a game, then delivering for the PC, the Xbox 360, the PS3, the Mac or whatever. Its just something horrible that we suffered through with Enemy Territory, or rather one of our partners did.

The target that we had, we knew when we were starting this generation of technology that the consoles were taking over the preeminence for the types of games wed been makingthe AAA media-rich blockbusters were on the consoles. We needed a solution that would be portable across 360, PS3, PC, and OS X, but we didnt want to abandon our PC roots. And we have enough Apple boosters internally that the Mac remains a platform that we have some fondness for.

On a technical level, we had to make design decisions that would let us target all of these platforms, very importantly, from a single source-base, and developed [that] internally. We didnt want to have to go out to any other companies to produce these games. We wanted to say OK, heres the build and run the same build on the PC, the 360, and the PS3. We still have to go through one extra step to build it on the Mac. But it really does work that way on the other [console] platforms. Right now, you check the stuff in, the next day you get the build reports, which says, here it is [ready to go] on these three platforms. So thats one of the core technical aspects.

Will Smith: So one team is developing for four platforms at the same time (PC, 360, PS3, and OS X)? Thats really cool!

John Carmack: This is the first time weve done this at id, and we think weve done it better than many other companies. This is one source tree and one environment, you build it and it works well on all these. Different platforms have had different amounts of elbow grease on them. Certain things are easier on the 360 than the PS3, but you put the extra effort in where its required. You dont want to minimum common denominator it, and just do whats easy on the different platforms. The intersection of that is not so great.

Tim Willits: One of the great things about the new id Tech 5 engine is that as a developer, you use the same set of assets on all of the platforms. You can immediately see what your game looks like on all the different platforms. For us, thats a great way of looking at development of games.

John Carmack: Our history as a PC developer lead us to a lot of development technologies that console developers generally didnt do. Through the Doom 3 generation we had all of this live update stuff, where a modeler could save out a model or save out an image. You could just hit one key in game, and it refreshes everything in the game around you. While we went through the Doom 3 porting process to the Xbox, our designers were appalled at how painful the process was. Ew, this takes hours to just make tiny changes there. Weve brought all of the goodness of PC development there to console developers.

During the development process [now], you can do the exact same thing: save this thing out, hit a key, and it magically pops up in the world around you. With a stamping on the Megatexture stuff, youve got even cooler demos, where you can be doing graffiti on the texture on the PC, and a guy walks around the corner on the PS3, and its magically there.

Tim Willits: So Rage, the other part of your question. Rage is a new franchise built on a first-person shooter foundation. But yet, it expands on that with more exploration, more action, and more adventure with some driving and vehicle combat.

John Carmack: Its explicitly not the corridor shooter that people have come to expect from id. It was a very conscious decision that this wont just be the next revision of the same game that ids made before.

Will Smith: It seems like youve taken inspiration for Rage from Mad Max

and everything else thats post apocalyptic and awesome. What would you say that youre juiced about and pulling on to make Rage?

Tim Willits: For us, its all about fun and making the game experience as enjoyable as possible. During development, whenever we hit a cross-roads between realism and fun, we take the fun path. We would love for game players, after they finish Rage to say, that game was fun. I had a great time.

John Carmack: And that actually, there are some technical points that we tie in there. I was very proud of the Doom 3 generation, where I unified all these things: static and dynamic lighting, static and dynamic geometry. It was technically elegant and wonderful, and was this thing that I was quite proud of as a setup. Were making completely different decisions on Rage. Im not trying at all to be perfectly uniform or elegant in whatever way. Were doing a lot more of the traditional gaming hacks in the technology, because were a 60Hz game. Were totally blazing fast because Rage is a 60Hz game. We want to be responsive for the driving side of things, and that carries over into a silky-smooth sense of play even with all the other first-person sides of things.

That also plays into our grand strategic plan with all this generation of technology. Were ramping up to do another Doom game, built on id Tech 5. But its going to be a 30Hz game. Even though were not changing the engine, we get to throw three times as much horsepower at it, so its going to look like a totally new game engine on there, even though its going to be built on the four years of effort that we spent developing this generation of technology.

Will Smith: So, you said Rage is a 60Hz game. Is it an OpenGL or DirectX game?

John Carmack: Its still OpenGL, although we obviously use a D3D-ish API [on the Xbox 360], and CG on the PS3. Its interesting how little of the technology cares what API youre using and what generation of the technology youre on. Youve got a small handful of files that care about what API theyre on, and millions of lines of code that are agnostic to the platform that theyre on.

Will Smith: Are you using DirectX 9 equivalent? For Doom 4 as well?

John Carmack: Yes to both. Its one of those things I get asked a lot. Whats big and exciting for DirectX 10 or DirectX 11? Theres not a whole lot of really not a whole lot. The big touted geometry shaders were in many ways, a mistaken belief that people desperately wanted to create stencil shadow volume.

Theres a tough thing with that. You get a bunch of people who make APIs, and they think its my job to make APIs. I make new APIs every year. Theres a reality of approaching a functionality curve, and the DX9 level gives us a whole lot of stuff where its not like before, even at the DX7 functionality level. Graphics programmers have tried every possible configuration, and theyve tried every state and know what happens when. But, as soon as you get programmability in there (as happened with DX9) youre writing code now. The code is limited, but were so far from exhausting the possibilities.

Sure, when DX10 hardware is ubiquitous and thats our baseline platform, well find something useful to do with all that extra hardware. Its not like were saying no, we wont use this.

Will Smith: Do you think weve reached a point of diminishing returns with regard to graphics?

John Carmack: Therere interesting things to talk about in that direction, [for example] with Quake Live. Were taking this ancient graphics technology, its nine years old, but were wrapping it in this other way to innovate, with the website interface for all of that. Its clear that there are certain types of games that were past the curve for the benefit. For the highly competitive games, competitors would crank the detail all the way down, sometimes going too far. Its cool that were running those games now at 60Hz on 2 million-pixel monitors.

Theres still value to be gained at the high end with graphics. Weve got some wonderful looking stuff with Rage where we can do things with the environments that people have never seen before. Rage and id tech 5 will make a lot of games start to look plain. Weve seen that phenomenon with previous games, where people dont know exactly what theyre missing until theyre shown it, but it makes some of the other things look shabby in comparison.

I still think theres one more generation to be had where we virtualize geometry with id Tech 6 and do some things that are truly revolutionary.

Will Smith: How long will we see games based on id Tech 5?

John Carmack: Through this console generation at least, I am beginning some of the preliminary research work on what were going to follow this up with on the following console generation. Lots of questions are unanswered about that, depending on how all the players choose their technologywhether it ends up being a Larrabee based, CUDA hybrid, or Fusion-based, therere lots of unanswered questions. I know we can deliver a next-gen kick, if we can virtualize the geometry like we virtualized the textures; we can do things that no ones ever seen in games before. Its worth doing a new generation for.

Will Smith: So this isnt your last engine?

John Carmack: No. Its interesting though, that a couple of years ago, Id thought that maybe we were approaching something that would be a regular tool, that the performance is a driving factor. You could write something really general, but the performance is hard, even for a 30Hz game.

In some ways, our big advances are in tools. Our innovations are beyond the offline renderers. Were doing stuff that even the offline renderers dont.

Chapter 33

Quelling The Rage

This interview was conducted by Chris Remo for Gamasutra on Aug 01, 2008.

Interview

Prologue

Id co-founder John Carmack - co-creator of franchises such as Doom and Quake and coding pioneer - is not known for self-censorship. It's thus interesting to hear him speak as positively as he does about his company's recently-announced relationship with Electronic Arts, which will be publishing its first-person, post-apocalyptic driver/shooter Rage for Xbox 360, PlayStation 3, and PC.

Here, Carmack, joined by id lead designer Tim Willits and David DeMartini, general manager at EAP, discuss the relationship, the game's move to a primary console focus, the broader philosophy that lead to the development of the title, and the future of the company itself.

Questions

Chris Remo: I guess the most obvious question is: how did the EA/id thing come about in the first place?

John Carmack: Well, everybody knew that, or, most people know, at least, that id doesn't sign long-term contracts. Every title that we've had really has been negotiated separately. We have a long history with Activision - we've had a lot of success over the years - but we've had a couple disappointments, recently, with our partner titles... and Rage is a brand new IP, it's a fresh start for us in a lot of ways, so we did go out and broadly shop, looking really critically at all of our publishing options.

And, of course, in the end it came down to like four publishers - you could probably pick which four - and out of that, there's kind of a tier where you've got Activision and EA at the top, and then a couple others below that. And everybody made strong offers; all of them came to the table with a lot of money, good terms, and all of this.

In the end, the decision came down more to secondary factors: about how we thought that the company viewed us in relation to their other projects, what the top executives would think about our products competing with other products they might have internally, how they viewed our game and what they thought we'd do for them.

And we had, surprisingly - if you had asked me five years ago if we would be considering EA, I would've said, probably, no. Because I carried around, really, some outdated prejudices about EA, the big evil empire of gaming, that kind of bought and crushed and squashed a lot of small, creative stuff.

Chris Remo: They admitted as such recently; John Riccitiello did.

John Carmack: But when it turned out that we went in and we checked on some of these things, we talked with the developers in the EA Partners program, and we talked to Valve, and some of the other guys who we know, and at this point they say universally positive things about how working with EA has been.

I think there really has been a major intentional corporate change there.

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It came down from on high; it's like, "We're going to change the way things are done here." And the people that are there right now are happy working with EA, and I've looked over everything - it was a tough call, certainly; everything was strong out there, but we made the call to go with EA, and we're happy with how things are looking right now, and certainly going to be another question that comes up when we start shopping Doom IV.

David DeMartini: We're in day one of the marriage, and they're really happy, so...! (laughter from all)

The wedding day's been great, and all that other kind of stuff; and, you know, from this point forward you have to earn the business. Because, as John says, they sign one deal at a time. Which we're perfectly happy with, because in this business you're only as good as your last deal. They're only as good as their last game, and we're only as good as our last deal, and we're only as good as what we said we would do and then what we actually did.

And then now comes the time where we need to provide the appropriate service to the business, and do what we need to do to be the good partner that we said we would be. And we're very confident that with the right, humble attitude, that we will earn the business time and time again with partners like id.

Tim Willits: You know, one of the things, just to add to what John said about the top tier at EA, is, when we're coming down to the final decision, you know, Riccitiello and Frank Gibeau flew out to id and they gave them the game demo, and David was there, and all the EA people asked really intelligent game player questions. They were asking things about other games, and what we thought of this and that, and we were, as game players and game developers, very impressed that these guys at the very top, that run this huge company, are actually hardcore gamers. Moreso than I think people would realize, and it really impressed us.

Chris Remo: It's interesting because - I mean, I've talked with you about this before - I've been following EA Partners for a while, and though I didn't know anything about this deal, it actually didn't surprise me too much, because you've got Crytek, you've got Valve, and they're some of the only developers that are sort of similar in spirit to id. And I'm won-

dering if that influenced this at all.

John Carmack: I mean, the fact that they're happy with the relationship there meant a lot; and [Valve's] Gabe [Newell]'s gonna speak his honest opinion on everything like that.

And we got positive responses on that. And it is interesting, when we look at some of the premiere first-person action titles on there... We all looked at it, and we don't think that we're being - none of us are doing kind-of head-to-head bashing titles that are going to be competing against them; Rage is a different flavor than what any of these other things are going for, so it should be an amicable set of partner companies that are working on this, here.

Chris Remo: Any chance of id products being on Steam in the future?

Tim Willits: Well, we have our catalog...

Chris Remo: You have your catalog on there, but in terms of newer games - Activision put some of that stuff up there, but EA often goes for the EA Link thing; but also, Valve is working with EA Partners, so it's kind of a big weird soup.

John Carmack: Right now, we are looking at it - for Rage - as the consoles are the most important "legs" that this project is on. It's definitely shipping on PC as well, and we would be willing to entertain different distribution notions on that, but we would probably leave that up to EA's decision on thereabout.

They're the publisher, and they're going to pick out the best way to get this out to the most number of people; and when EA decides that they think that it's going to be better to cut some deal for electronic distribution, and possibly avoid retailers, or whatever, we'll probably take their advice on that.

Chris Remo: Any comment on that? Probably not?

David DeMartini: No.

Chris Remo: OK! (laughs)

David DeMartini: No, I mean, before I would've said, "Just leave it at the

no," but what I think we'd say is: game players are getting their games from a variety of sources - from retail, electronic distribution - and EA is committed to being on every viable platform and means of distribution, so that we could get their great game out into as many hands as possible.

So I don't think there's any preconceived "yes" or "no" on any platform, or any method of distribution. Obviously we're developing our own, and we're trying to make that experience as great as possible for game players; we do Direct2Drive, we do other partners, and I don't think that there's any viable entity that we just immediately say "no" to.

Chris Remo: There have been reports of some developers being dissatisfied or uneasy about the Activision/Vivendi merger, and I'm wondering if you guys had any misgivings about that in any way.

John Carmack: Not specifically; I mean, we have our set of internal issues with Activision, which we're not just going to all air, but we don't have any burned bridges with Activision either. They're still publishing Wolfenstein for us, there... It's certainly a big shake-up in the industry.

And there's probably going to be the various consolidation things that happen, and I'm sure it's going to spawn lots of other new studios, as other people decide they don't want to be part of this big thing; jump off and do their thing, or their studio gets axed and they go form something else... So it's hard to say exactly what the impact on the industry is.

I'm sure it's actually putting EA on notice to some degree; they've lost their "number one" by a certain however-you-choose-to-count-it metric, and that probably is beneficial for them, by getting a fire lit and going on that...

Chris Remo: Well also, gamers have a new whipping boy at this point.

John Carmack: Yeah.

David DeMartini: Well, I think the other thing, too, is - you know, not that I would go out of my way to defend Activision, but - I would hope that, moreso than Activision losing this business, EA won this business, and I like to think that that's the approach that we take to all of these things. We're not trying to beat Activision; we're trying to be the best publisher we can possibly be, so that we're attractive to companies like id.

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And, you know, with a property like Rage, that is so premiere, and so highly anticipated - and anything they've ever done internally has been great, flat-out great, and customers love it - I think it's more an issue of we were highly attracted to id, we were highly attracted to a new IP from id, and we really reached out and tried to win the business by the services that we were offering, and the commitment that we were making to id.

Hopefully, that's the way I would characterize it, moreso than "Activision did a bad job and they left." I don't think that's fair to Activision, much like if a partner left us and went with Activision, they wouldn't say, "Oh, EA screwed it all up, and that's why we left." So, I think it just demonstrates our commitment to the developers, and we're very happy that we won this business.

Chris Remo: Fair enough. It's been a while since you guys introduced a 100% new franchise. Obviously, you guys made your name on Doom and things that you built from the ground up - is there a lot of pressure there? What does it feel like, internally?

John Carmack: Certainly we have our marquee titles, with Wolfenstein, Doom, and Quake; and Doom really is the big gun out of that, the one that everybody remembers. "That's the game I played in college!" We certainly expect to carry on with that, but there is a sense that in the community at large, if we were doing a Quake 5, Doom 4, Wolfenstein 4, just running all of that...

Even if people love it, and you can make - as EA has shown, you can run the sports titles every year, and people will love it, and as Activision is showing, you can sell Call of Duty every year, and people will love it.

We did feel some pressure to try and strike out, and do something different. And there are certain things that we've always been dinged on, in the community, about our games. Some of which were to some degree intentional, but people talk about, "It's too dark! It's too cramped! It's all indoors!" You know, the prototypical corridor shooter, and we did want to branch out from that.

I mean, there are still great things you can do inside any given niche like that, but we wanted to really strongly address some of those things. It's a bright, outdoor, post-apocalyptic desert world. It's a lot of the things that,

while still a technological showpiece, in many ways, it's not limited in the way that Doom 3 was, and it's going to hopefully be a broader appeal to the game, with not so much the, "Be scared out of your wits while you're running around tense," all bunched up, playing the game. It should be a more fun experience in a lot of ways; and we wanted to consciously address some of these things.

There are certain things that we know we can do great. We can build up the excitement, and the tension, and the competitiveness, and get people's pulse pounding; we can do all of these things, we've always been able to do them well, and we've got better tools now, so we can do them even better. But, there's a lot more to gaming than just that aspect, there, and we do want to build our skills.

There are things that - some of the hardest that we do, we have never done a driving game, so for some of the driving aspects of it, we decided to focus on that early, and make sure that we've got this cool stuff, running around, driving in the wasteland, shooting at things, and racing. But that's only an aspect of the game. We keep all the things we've always been good at, we add some new things, we learn how to be good at it, and then we build the whole mix together.

Tim Willits: Yes. I mean, John said it much better than I would say it, but yes, internally we wanted to do something different, something exciting, but we wanted to keep it grounded in that first-person shooter. And so it's important for people to know that it is a first-person action game, with some exploration, you have some vehicle combat, but it's not a race game, and we're really excited about it. It really allows us to innovate the genre that we created, and expand it while making it better.

John Carmack: Now it is actually worth noting, as a little aside, that it's not actually the first new IP in a long time, because our mobile titles - which was our entry into the relationship with EA, with Orcs and Elves. And the mobile titles have been really successful; we've sold over two million units on the mobile titles.

And we have a Wolfenstein RPG with a whole new engine coming out, and that was sort of our foot in the door with EA, where people we were working with at Jamdat moved to EA, and those became the guys that we knew that are at EA, which boosted us up to start talking with EA Partners

people.

David DeMartini: And that's what really attracted us to id. I mean, when you hear the guys talk, you know, talking about constantly getting better. Not resting on their laurels, if you will, or continuing to deliver more of the same, but taking their creative efforts and their technology efforts to the next level.

So idTech 5 takes the technology to the next level, the fellas are working on a design which takes it to the next level, and not only does what id has done great, but starts to evolve their skill set with driving, and some of the other elements that are in the game. So you get all the great stuff that you always got from id, but you get an additional set of fun factors that you'll be able to play with Rage, that take that game to the next level.

So, whether it's baseball, or sports, or in business, what you're always looking for is partners who are trying to get better, constantly improve, and take their whatever-they-do to the next level. We hope that EAP does that same kind of thing by taking our services to the next level, and constantly get... We don't always get it right every time on every element, but when you screw up, have the integrity to say, "Hey, screwed that up; I'm gonna fix this."

Same kind of thing with id, and where id wants to go with - you know, like John was saying, they started this project four years ago, and they spent a year working on this project and then said, "This doesn't feel like this is going to be the next level of what we want to do with this title. So we're going to scrap that, and we're going to start all over again." So many other organizations would've tried to figure out how to salvage what they started, so they didn't toss that year; these guys learned from that year and built off of that to make it even better, and I think Rage is going to benefit from all that time that was spent.

Chris Remo: I've been playing id games since Wolfenstein 3D, and when I was at QuakeCon last year, it was really almost astonishing to me how many disparate genre elements you're bringing into Rage. Which is an unusual thing for a developer that has made its name on really establishing one genre, and I'm wondering how much you had to, or if you had to, modify your internal design processes to deal with that.

John Carmack: Yeah, it is a tough call, because I've always argued against "kitchen sink" gaming design, and that's a real problem with modern games, where the idea is that you throw hundreds of people at it and make sure that you have everything in there.

There are some extremely successful games that are built along that model, of "have everything, give people nothing that they could criticize us for" - but we're not a team size big enough to do that. I wouldn't really want to do that type of thing, but we knew that we wanted to do certain things different; the idea of setting it out in the brighter outdoor area, that was one of the preeminent things.

I mean, the first game, that we rebooted, was called Darkness. And I was thinking, "This is just going to be another thing that people hate us for - the exact same things." So we're going to go ahead and do the "running over mutants in a pickup truck" sorta thing, in the outside.

But we feel we retired most of the risk for the driving side of things; the last big question is the more adventureish, RPGish side of things - which, of course, is the hardest thing to retire, because you wind up meeting the entire game, there, and finding out how fun it is to go take these tasks, around that. And that's the remaining thing, that none of us internally have built games like that, except for cellphone games, to a minor degree.

But we went through the driving aspect, and we hadn't done this, but we've got stuff that's fun now; it's fun to sit down, drive around, and either race or shoot at other cars, and mow down things. So, we can build the skills; we've got extremely talented people on all sorts of levels, and we can learn what's necessary to do any of these different tasks.

We went into this knowing that we had the humility to say, "We're great at what we do, and we're all smart, and we're all talented; we can learn these other things, but we don't know it yet." And we have to go in with this "freedom to fail" sort of approach. We're going to go take some cuts at it, we don't expect it to be right first, and we'll work on it as long as it takes.

Chris Remo: The focus on Rage is the consoles. I think that's understandable, these days, from a market perspective, but I'm wondering, from a development perspective, again, if that is something of a shift in the way

that you have to think about the project.

John Carmack: Well, it's a lot of fun, actually, going and working on the different console platforms. I mean, I enjoy doing that type of stuff. The mobile phones are fun, the 360 and PS3 stuff is. It's fun to look at the different challenges. You've got the set of all these technical things here, and figuring out the right set of techniques and organizations for all of that, I love that type of stuff.

I do miss, in some ways, the, "Let's just stay at the bleeding edge on the PC; work real closely with all the hardware vendors so that you're using the latest stuff the minute it comes out," but there are days when I'm like, "Wow, it would be nice to develop just for the 360," you know? If you just want to make games, it would be great to just do that, and not have to worry about driver updates, and all the different hardware SKUs on there.

So we're still trying to do things that - the Quake Live project is all about, "Let's do something that the PC is uniquely good at," because the console is still a crappy web browser, and it's still not as good as a keyboard-mouse interface; it's just not. So there are things that the PC is better at, and we want to take advantage of that.

And there's exciting stuff that we can do on the mobile, but for the big, blockbuster, media-rich, triple-A titles? You have to be cross-platform across the platforms. If you're going to devote the tens of millions of dollars that it takes to make one of these games, you just really need to be there, just from a business reality sort of standpoint.

Chris Remo: How big is the team on this game? Approximately.

John Carmack: Well, id now is up to 60 people and growing, because we're actively growing now, as we plan to move up a second team to do a Doom project. And, historically, we're still a tiny team; we've grown very slowly over the years; we've had very little attrition, and we usually bring on one or two people a year, but now we're hiring good people as fast as we can find them. We're only taking people that are great on here. It's tough, you can't just snap your fingers and say, "I want 30 hot-shot developers to drop what they're doing and jump on to our project."

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But, internally, we have the Rage team now, which is... How many people are on Rage exclusively? It's easier to go the other way, and say we have the Quake Live team, which has six or eight people.

Tim Willits: Eight. About eight people, yeah.

John Carmack: Eight people on there, with some contractors working on it. And we have the id Mobile team, which only has like six people or something, on that. So that means we've got 45-some-odd people on Rage, and then a few other people that are cross-support on different things.

And we expect to be growing - I don't expect that you'll see id at 100 people in the next several years... I don't think we'll get to 100 people in that time. We're looking, for the Doom project, we want to fill out, have 30 or 40 people that are Doom guys, and then we want to be able to migrate resources between the other teams as they start the normal pipelines that most developers are in, that id's really been sort-of a laggard in coming to, where you want to be able to have the previous team going, and starting the work on another one.

Because we have been very efficient like that, where we have the entire team come off of Doom 3 - now a lot of people go to try and help the partners, help with Quake Wars: Enemy Territory, porting on that, but still, you're kind of left with a chunk of people more or less twiddling their thumbs, because it's not the right time to power them onto the project, and that's hurt us in terms of the utilization, and we want to be able to do a better job with that in the future.

Chris Remo: I almost dread to ask this, because it doesn't seem like the type of question that you would usually be into, but do you have any comments on what management structure you use, in terms of Scrum or agile, or anything like that?

Tim Willits: Well, for us, we have no real model. Sometimes we have Scrums, with the artists, we try to be agile as much as we possibly can, but it's really about talking to people, putting the best people on the projects, and staying on top of it.

John Carmack: But I will say, specifically, that that has never been a

strength of id Software for people to emulate! And we have a much better team, in a lot of ways, than we used to. We used to have a, just a deserved reputation, for having a bunch of prima donnas - talented prima donnas, but, you know...

Tim Willits: Don't point at me! (laughter)

John Carmack: But we have, especially with this project - to some degree through Doom 3, but definitely throughout this project - we have a lot more mature developers, and a lot of it is just that as people get older, and they are more mature about the way they look at it. This is your career; this is what you do. And they're going to be disciplined about it.

But the growth of a dozen, or two dozen people up there, to 60-something people, there are growing pains there. But those are, again, tasks that we look at and say, "These are challenges; we don't have the right answers; we need to learn what the right answers are," and go into that as a learning experience. And we're getting better at a lot of things there, and we're pretty thankful that things have been as placid as they have been.