Daniel Chan
San Francisco, CA
213-268-8268
danchan@gmail.com

Experience

Activision/Blizzard/Sledgehammer Games, Foster City, CA August 2009 - Present

Principal Engineer/Lead Rendering

Call of Duty: WWII

Performed experiments in material capture using a 3D-printed, Arduino-based reflectometer for BRDF measurement. Captured SVBRDF using a hemispherical dome of lights and a single camera, using linear programming for the initial diffuse albedo and normal solution, and non-linear optimization for the final diffuse albedo, normal, gloss and F_0 determination.

Developed Multiscattering Diffuse BRDF shader for greater material differentiation throughout the gloss range. Developed technique for auto-generation of mesosurface occlusion textures from normal maps. Developed novel technique for mipmapping of normal and gloss textures, taking into account the specific normal distribution function used (in our case, GGX).

In the last year of development, task-managed a team of twenty engineers to add full HDR TV support, "prebaked" Tessellation and Displacement, realistic single-scattering fog, "Residual Lighting", among other features.

Call of Duty: Advanced Warfare

Developed new full HDR rendering pipeline. Modified light baking tools to output HDR. Fixed fundamental bugs in the light baking tool preventing it from outputting photorealistic results. Developed tonemapping curve and novel exposure curve techniques for cinematic photographic control over the final rendered image. Processed industrial glossmeter data into gloss values that could be used in engine. Developed diffuse albedo capture methodology. Modified the game engine to accept real-world lighting values, and developed method for measurement of real-world lighting values and capture of skyboxes.

Converted all material shaders to physically-based material shaders, utilizing state of art techniques for calculating correct directional-hemispherical reflectance, reflection probe convolution, and specular reflection using a microfacet model.

In the last year of development, task-managed a team of twenty engineers to add skin shaders, depth of field, screen space reflections, motion blur, veiling luminance (bloom), line and bulb punctual lights, and medium distance ambient occlusion, among other features.

Call of Duty: Modern Warfare 3

Took over the rendering codebase from previous developers, as primary rendering engineer. Documented the major systems for rendering including the Material Factory, a shader templating engine. Developed custom material shaders and post effects shaders, like Screen Space Ambient Occlusion. Added proper filter kernels for generating mipmaps. Analyzed graphics rendering performance and provided clear plans on authoring-side optimizations.

Electronic Arts/Visceral Games, Redwood Shores, CA February 2009 - August 2009

Senior Software Engineer III - Unannounced Title and Dead Space 2

Developed verlet-based cloth physics component which simulated cloth nodes that were mapped to character bones. Allowed different cloth topologies and constraints to be easily added. Cape topology was developed which was stable and rendered plausible movement and interaction with character.

Optimization of overlay/decal system used for rendering blood splatters and gunshot damage through reduction of L2 cache misses, reduction of render state changes, reduction of draw calls, and replacement of immediate-mode rendering with double-buffered vertex buffers. Achieved 5x speedup of rendering of rigid decals.

Namco Bandai Games America, Santa Clara, CA **July 2006 - January 2009**

Lead Programmer - Afro Samurai

Oversaw development of a full XBox 360/PS3 game engine, including all build tools plus pipeline, all designer tools, and run-time code. Utilized parts of the Heroes & Giants game engine to help accelerate development and licensed those parts for free. Worked closely with artists and designers to make sure tools met their needs.

Personally responsible for development of level build tools and pipeline, physics-based effects, run-time framework, resource management, and dynamic dismemberment of skinned characters (a first in videogames).

Worked closely with Lead Artist to create shaders used to achieve the illustrated style of the graphics. The illustrated look of Afro Samurai was singled out by gaming press as unique and highly stylized.

Heroes & Giants LLC, Palo Alto, CA **September 2002 – January 2006**

Co-Founder/Programmer

Contract programming for Electronic Arts Redwood Shores on "From Russia with Love" - Developed multiplayer mode including support for multiple viewports and multiple controllable characters. With a programming partner, ported the game from PS2/XBox to the Nintendo Gamecube in four months, requiring reduction and re-budgeting of art assets, reverse engineering of undocumented binary game assets, and porting and optimizing the rendering engine.

Developed self-published "Hamster Golf" cell phone game for BREW platform using lightweight version of Heroes & Giants game engine in three months.

Contract programming for Crystal Dynamics - Developed a graphical node editor that used force-directed layout to efficiently and clearly perform automatic layout of complex node topologies.

Contract programming for Electronic Arts Redwood Shorts - Developed prototype for a third-person action game where the character had a complex and innovative moveset, in three weeks.

Developed game engine for PC. Personally responsible for a seamless streaming level-of-detail terrain engine, a light scattering shader, a BRDF shader using separable decompositions, a network communications layer for multiplayer gameplay, a cloth physics module, a collision system, a software rasterizer and level build tools and pipeline.

Daypop, Los Angeles, CA **April 2001 – September 2002**

Founder/Programmer

Created and developed Daypop, the world's first real-time search engine for the dynamic "living web". The search engines at the time were refreshing their full-web indexes every few months while Daypop set out with the explicit goal of indexing the frequently changing web (blogs and news sites) every hour. Featured in the Wall Street Journal, Wired.com, About.com, Yahoo! Picks, and CNET, among others.

Developed web crawler, HTML parser, indexer, link ranker and fast query system on top of FreeBSD, Apache, MySQL and Perl. Solved problems related to setting up and maintaining a web server, creating Apache extensions in C, and optimization of search queries. Launched in early September 2001, Daypop and especially Daypop's Top 40 list became well-known among bloggers and researchers interested in the current "buzz" on the Web.

Additional development that went live include ranking news links, ranking of Amazon wishlist items and word burst analysis (the first implementation of this on the Web). Continued with development of distributed spidering and a fault-tolerant distributed storage system, as well as techniques for performing similarity searches.

Naughty Dog, Santa Monica, CA **March 1998 – December 1999**

Lead Programmer - Crash Team Racing

Developed entire game engine from scratch. At the time, Naughty Dog only had experience with creating games on "rails" (Crash Bandicoot). The goal was to create a free-roaming 3D engine that displayed the entire world infinitely into the distance, hosting four players split-screen on the Playstation at 30fps. This was never achieved before or since on the Playstation.

Developed an efficient seamless level-of-detail system that avoided blocky textures up-close using texture

"montages". Personally responsible for build tools and pipeline, including tool for generating potentially visible sets, run-time framework, collision system and renderer. The ideas developed for Crash Team Racing would later be adapted for use on the Playstation 2 by the Jak and Daxter team.

Crystal Dynamics, Menlo Park, CA **June 1994 – March 1998**

Senior Programmer - Gex: Enter the Gecko

Co-authored the "Gex3D Engine" for "Gex: Enter the Gecko", one of the first free-roaming 3D third-person platformers on the Playstation. The engine was also used for Soul Reaver, Soul Reaver 2, and Akuji the Heartless. Engine was later ported to Nintendo 64, Dreamcast, PC, PS2, XBox, PS3, and XBox 360 and evolved into the one used for the latest Tomb Raider games coming from Crystal Dynamics.

Developed build tools and pipeline, designer texturing tool, run-time framework, world renderer, collision system and scripting language, among other things.

Programmer - Gex

Responsible for supporting the scripting system in the Gex 2D sidescrolling engine developed for the 3DO. Oversaw and taught team of three game designer/scripters to produce all the character behavior in the game. Personally responsible for many of the boss behaviors in the game. Spearheaded late-night design of extra bonus world.

LSI Logic, Milpitas, CA **May 1993 – December 1993**

Engineer - PSX team

Developed test suites for the PSX, the codename for what would become the Playstation MIPS-based processor.

Talks and Publications

SIGGRAPH 2018 course, Advances in Real-Time Rendering
Material Advances in Call of Duty: WWII

SIGGRAPH 2015 course, Physically-Based Shading in Theory and Practice
Real-World Measurements in Call of Duty: Advanced Warfare

Game Developer Conference 2009
Style in Rendering: The History and Technique Behind AFRO SAMURAI's Look

Education

BA in Computer Science, **1990 - 1994**
University of California, Berkeley

Courses taken include A.I. (using Scheme), 3D Graphics (from rendering a pixel to fully software rasterized 3D worlds), Operating System Design, Compiler Design, Networking, Hardware Design (building a small 4-bit computer), and Hardware Design through Software Simulation (building a MIPS processor).

Programming Languages and Tools

C, C++, HLSL, Perforce, Visual Studio, Wolfram Mathematica, Photoshop, Maya

Interests

Guitar, Mandolin, Banjo and Songwriting (Bluegrass, Rock, Folk, Pop), Open Mics, Large Format Photography, Bicycling