

Nathan Reed

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I'm a graphics programmer, an amateur physicist, and a sci-fi nerd. I teach computers how to make pretty pictures. I'm excited by the art of creating beautiful, immersive worlds and telling stories in them. I enjoy playing with esoteric ideas, and explaining how things work.

Skills

- Expert on cutting-edge real-time rendering techniques, including physically-based shading, volumetric lighting/haze/fog, skin/hair/eye shading, particle systems and visual effects, postprocessing
- Proficient with GPU and CPU performance analysis and optimization, GPU and CPU hardware architecture
- Instruments of choice: C/C++, Python, D3D11, HLSL, Maya, Photoshop

Experience

NVIDIA, Developer Technology, Santa Clara CA (May 2013—April 2016)

- Principal role in developing GameWorks VR graphics technologies, including VR SLI, Multi-Res Shading, and VR Direct Mode display.
- Integrated multi-res shading tech into Unreal Engine 4, for 25–50% perf gain.
- Defined, tested, and supported D3D extension APIs for fast geometry shader and viewport broadcast features of Maxwell GPUs.
- Worked with game developers to resolve GPU performance problems and integrate GameWorks middleware in high-profile PC titles, including *Titanfall*, *Batman: Arkham Knight*, *Middle-Earth: Shadow of Mordor*, and *Evolve*.
- Upgraded *Fracture* demo for Tegra K1 launch, implementing real-time reflected and refracted caustics in OpenGL 4.4 using tessellation and geometry shaders.

Sucker Punch Productions, Bellevue WA (June 2008—May 2013)

Infamous: Second Son (PS4, shipped March 2014)

- Led effort to add HDR rendering to our engine. Implemented HDR lighting, postprocessing, exposure and tonemapping. Worked with art team to design HDR workflow, and helped train artists in the new system. Drove company efforts to capture real-world HDR lighting data for reference.
- Developed major rendering features: real-time wetness/puddles/rain system; high-quality depth-of-field effect; sky and atmospheric scattering; indirect specular lighting with local-area cubemaps and raytraced reflection imposters.
- Developed in-engine hierarchical GPU profiler; investigated bottlenecks on PS4 hardware and improved shadow-mapping performance by 4 ms.

Infamous: Festival of Blood (PS3, shipped October 2011; short downloadable title)

- As sole rendering programmer on this project, I designed, prioritized, scheduled, and implemented new rendering features as required by game design.
- Implemented 3D LUT color correction system, “vampire vision” rendering mode.

Infamous 2 (PS3, shipped June 2011)

- Developed “ambient occlusion field” techniques (see 2012 GDC talk).
- Implemented linear-space (gamma-correct) rendering throughout engine.
- Developed subsurface-scattering skin shader, and anisotropic hair shader.
- Developed GPU performance reporting tools, enabling art team to find and optimize expensive assets with minimal programmer assistance.

Infamous (PS3, shipped May 2009)

- Developed atmospheric haze/fog system, including innovative 2.5D approach giving the impression of detailed volumetric fog at a modest rendering cost.
- Developed ocean water shader with reflection, refraction, and depth-based fog.
- Implemented omnidirectional variance shadow mapping for underground levels.

Publications

Depth Precision Visualized (blog post, 2015)

How depth precision works, and why reversed-Z is so great.

NVIDIA GameWorks VR (SIGGRAPH 2015)

Overview of NVIDIA features and APIs targeted at VR graphics performance.

Data-Oriented Hash Table (blog post, 2015)

Or how I wrote a hash table in an hour that beats the pants off `unordered_map`.

The Buttered-Toast Model Of Radiometry (blog post, 2014)

Getting intuition for radiometric units using toast and other comestibles.

Artist-Friendly HDR with Exposure Values (blog post, 2014)

How to use photographers’ EV system to measure HDR light levels in games.

Why Do Quaternions Double-Cover? (blog post, 2014)

Delves into the math behind quaternions to explain the double-cover property.

On Vector Math Libraries (blog post, 2013)

Opinion/rant piece on how to build better vector math libraries.

How is the NDF Really Defined? (blog post, 2013)

Clearing up some confusion about the meaning of normal distribution functions.

Ambient Occlusion Fields and Decals in Infamous 2 (GDC 2012)

New ambient occlusion techniques I developed for *Infamous 2*.

Understanding BCn Texture Compression Formats (blog post, 2012)

Comprehensive comparison and discussion of the BC1–BC7 texture formats.

Education

Pomona College, Claremont CA (Sept 2004—May 2008)

- Bachelor of Arts in Computer Science; minor in mathematics
- GPA 3.92; elected to Phi Beta Kappa
- Senior thesis on module systems for object-oriented languages with structural typing and multiple interfaces per module