

Geo Viz vs. Pro/Game PC 3D Estranged or Partners?

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Shifting Innovation Magnet

- Innovations in 3D game ICs, APIs, content
 - Talent & technology migration to 3D games
 - Poor economics to optimize for Sci/Geo/Eng Vis
- Tricky allure of falling PC 3D cost in volume
 - Fiction: \$300 3D scaling up to Harmony, IR/Onyx
- 3D systems, ICs (vis sim, sci vis) challenged
 - Open, flexible systems vs. fast wired 3D pipes
 - Game 3D IC brute force + prog. shaders knocking



Bereft & Enchanted



Sci/Geo/Eng Visualization Needs

- Far-flung demands for modalities & fidelity
 - Physics, molecular, geo, medical, materials, fluids
 - Accuracy in humongous multivariate data sets
- Interactive visualization with data scalability
 - Geometry, display scaling - big data, rich formats
- Supercomputer scaling for hungry algorithms
 - Multi-CPU's, networked HW rendering, computing
 - Stable APIs, control of OS / libraries (Unix, Linux)



3D Game Propulsion

- Suspension of disbelief - reality & fantasy
 - Movies, player appeal, story values, relationships
 - Human cueing, evocative content performance
- Leapfrogging 3D power within a price cap
 - Real-time, low-lag, photo-reality, special effects
 - Animation/morphing of scene structure, content
- 3D supercomputing ICs - annual feature trek
 - API & content on steroids $\mu\text{sec}'\text{s} < \text{Xmas release}$



Game 3D Content



Images by ATI Radeon



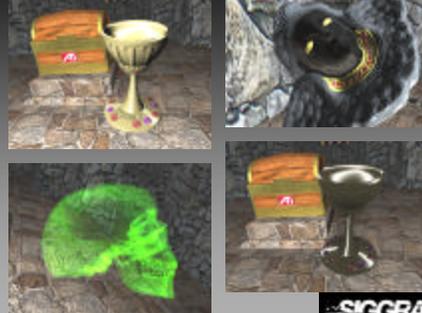
Game 3D Content



Images by ATI Radeon



Advanced Shaders



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Advanced Shaders



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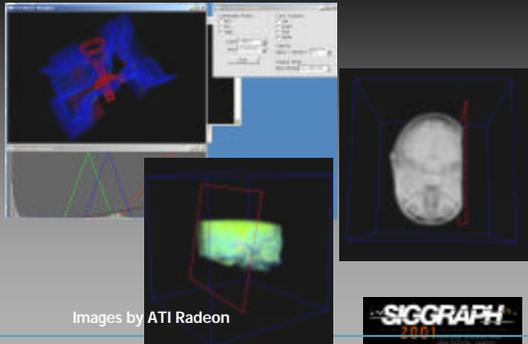
Advanced Shaders



Images by ATI Radeon



Game 3D in VolVis



Images by ATI Radeon



PC Urban Development Planning



Image by Evans & Sutherland



3D Chip & API Trends (D3D, OGL)

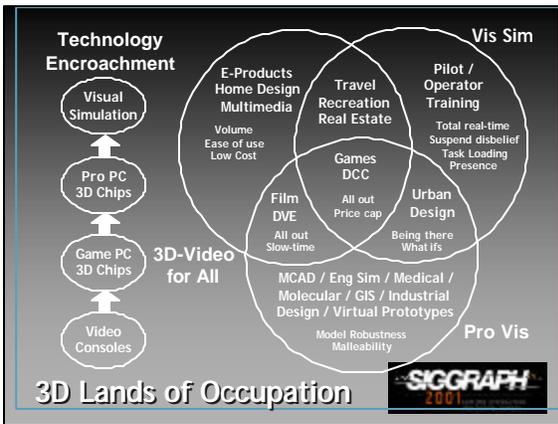
- Programmable 3D pipelines - lurking giant
 - Higher-order surfaces, prog. geometry shaders
 - Prog. pixel shaders for local lighting, texturing
- Contemporary & coming game / pro 3D ICs
 - Micro-polys (50-75 M Δ /s), high fill (1.2-1.5 GP/s)
 - Render to texture, unify FB+texture, fp precision
 - Multi-texture cascades, separable function lookups
 - 3D, BRDF, procedural texturing with A-A tradeoffs



Goal of Pro/Game Real-Time 3D



Image by Pixar



PC Geo Vis Sim Features

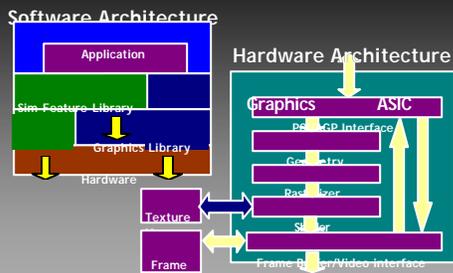


Latham's List	Gen. 3D	PC Sim	Beyond Latham	Gen. 3D	PC Sim
1. Parallel rendering for AA or TAA	-	✓	1. Basic sensor simulation	-	✓
2. Edge blending	-	✓	2. Adv. sensor simulation	-	✓
3. Geometry engine	✓	✓	3. Calligraphic lights	-	✓
4. Genlock	-	✓	4. Global texture	-	✓
5. Flexible video formats	✓	✓	5. Screen-door transparency	-	✓
6. Constant frame-rate mode	-	✓	6. Page LOD	-	✓
7. Load metric feedback	-	✓	7. Dynamic resolution	-	✓
8. Programmable gamma correction	✓	✓	8. Non-Linear Image Mapping	-	✓
9. Color space translation	✓	✓	9. Multiple image suppression	-	✓
10. Paged texture memory	✓	✓	10. Overlay plane	-	✓
11. Ownership illumination lights	✓	✓	11. True-range fog	-	✓
12. Coplanar (detail) faces	-	-	12. Anisotropic texture	-	✓

✓ available now
 - announced, or available but not completely satisfactory



PC Vis Simulation Feature Library



Scaling Up PC 3D for Sci/Geo Vis

- Extending game/pro 3D ICs and APIs
 - Deep data bit accuracy; higher geometry rates; more image area, depth complexity, A-A; tiling, binning, sorting for occlusion vs. direct FB access; pixel, frame multiplex – interleave mosaics; model / view segmenting for distributed rendering
- Scaling up performance (realities & pitfalls)



Sci / Geo / Eng Vis Advocacy Now

- **Join & help 'em, withheld voice = no voice**
 - Falling cost → personal Sci/Geo/Eng 3D computing
- **Market dynamic - few niches remain unfilled**
 - Commodity ICs + architecture glue — special needs
- **API strategy, drivers, RIs are key issues**
 - Stability, quality, leadership, costly stumbles
- **Think: *leverage* evolving 3D architecture**
- **Video: *Harmony, simFUSION, RAPIDsite, RapidScene, ATI Radeon***

