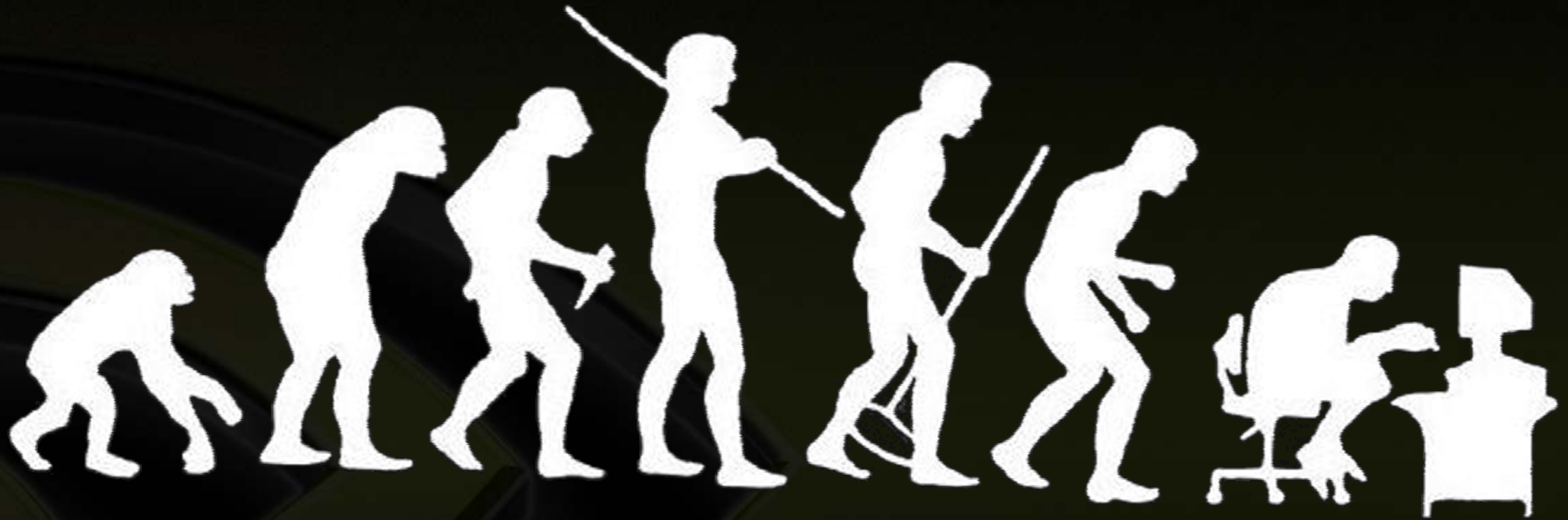**3D Graphics Hardware: Revolution or Evolution?**

Henry Moreton

Revolution vs. Evolution

- **Talented person has great idea**
- **The "silver bullet"**
- **But not usually**
  - **aspects left unaddressed**
- **Evolution**
  - **driven by inventions from smart people**
  - **kept on track by conservatives and traditionalists**
  - **sometimes the same people**

Evolution isn't necessarily always good....

Something, somewhere went terribly wrong

gallery.stonetable.org

Tessellation was revolutionary... several times...

- **Silicon Graphics VGX?**
  - **Caused pipe timeouts... never used.**
- **NV1**
  - **how do you use these things?**
- **NV20**
  - **smooth, slow and impossible to animate**
- **NV30**
  - **an untold story...**
- **NV40**
  - **phew...**
- **WGF?**
  - **Yes! well.... no.**

What is special about graphics?

- **Embarrassingly parallel...**
  - sure, we've said this for a long time

- **It is also very coherent...**
  - we tend to forget this.

- **We live and die by memory bandwidth and the efficiency of its use**

So where do we go from here?

- **Pretty much everything people want fouls up coherence... (and parallelism)**
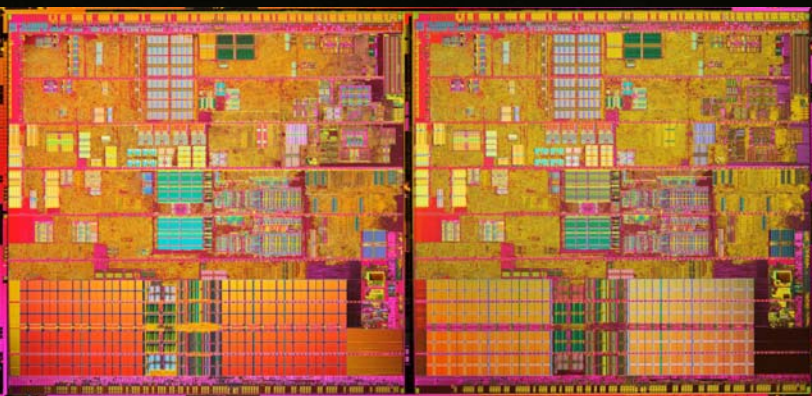
- **I'm not "just" whining...**

Realities of business

- Performance doubles each year

- New features exploited with 1-2 year lag

- Cost of new features carefully limited

- Handling less coherence efficiently
  is costly

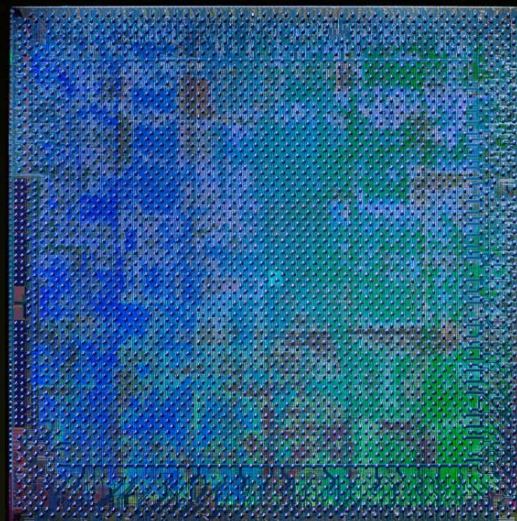# CPUs vs. GPUs

Pentium Extreme Edition 840
- 3.2 GHz Dual Core
- 230M Transistors
- 90nm process
- 206 mm^2
- 2 x 1MB Cache
- 25.6 GFlops

GeForce 7800 GTX
- 430 MHz
- 302M Transistors
- 110nm process
- 326 mm^2
- 313 GFlops (shader)
- 1.3 TFlops (total)

Efficiency of FLOPs delivered

		PEE 840	7800GTX	GPU/CPU
Graphics GFlops		25.6	1300	50.8
Shader GFlops		25.6	313	12.2
Die Area (mm^2)		206	326	1.6
Die Area normalized		206	218	1.1
Transistors (M)		230	302	1.3
Power (W)		130	65	0.5
Graphics	GFlops/mm	0.1	6.0	47.9
	GFlops/tr	0.1	4.3	38.7
	GFlops/W	0.2	20.0	101.6

Questions or comments?