

# Videogame graphics



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Associate Professor

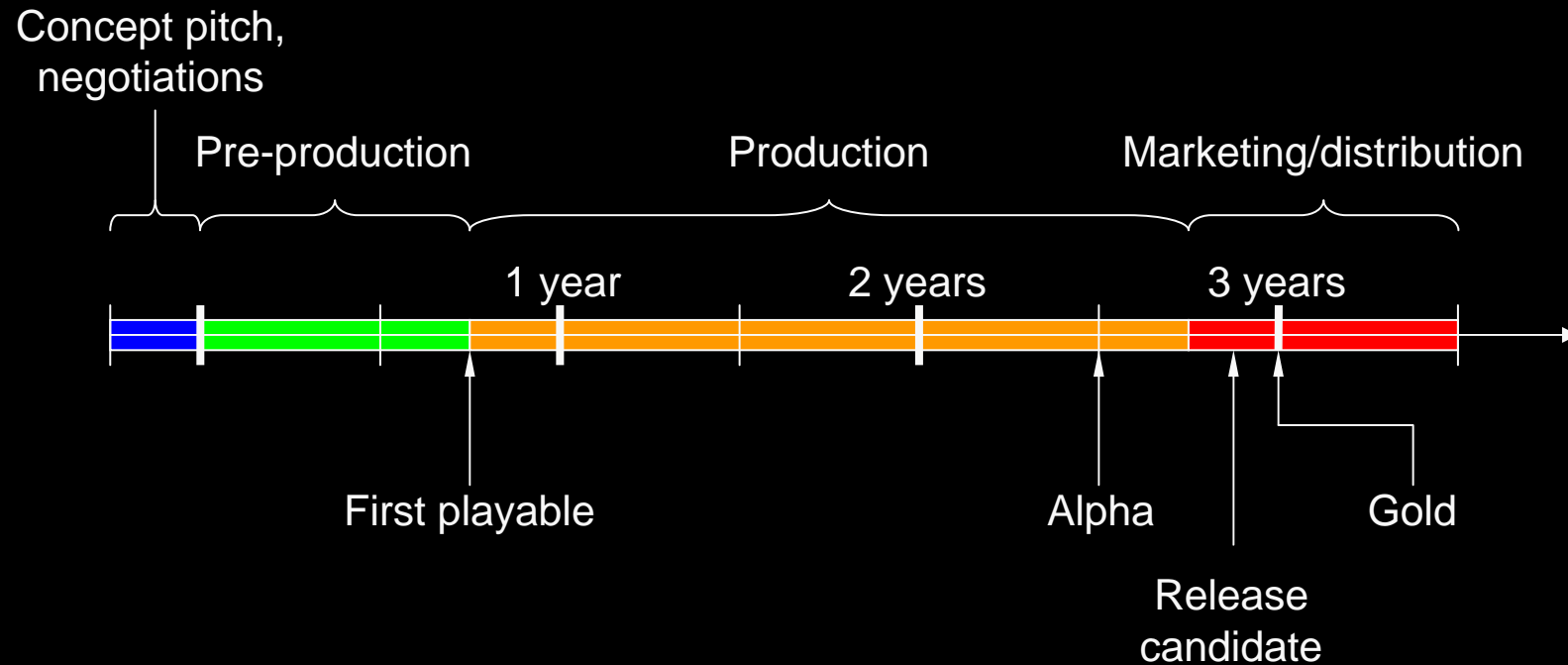
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# **Videogames – the business**

# Videogame development



# Financing

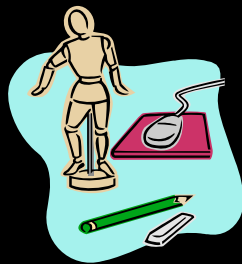
- Varies
- Independent studio or publisher-owned
- Excess from previous projects
- Royalties





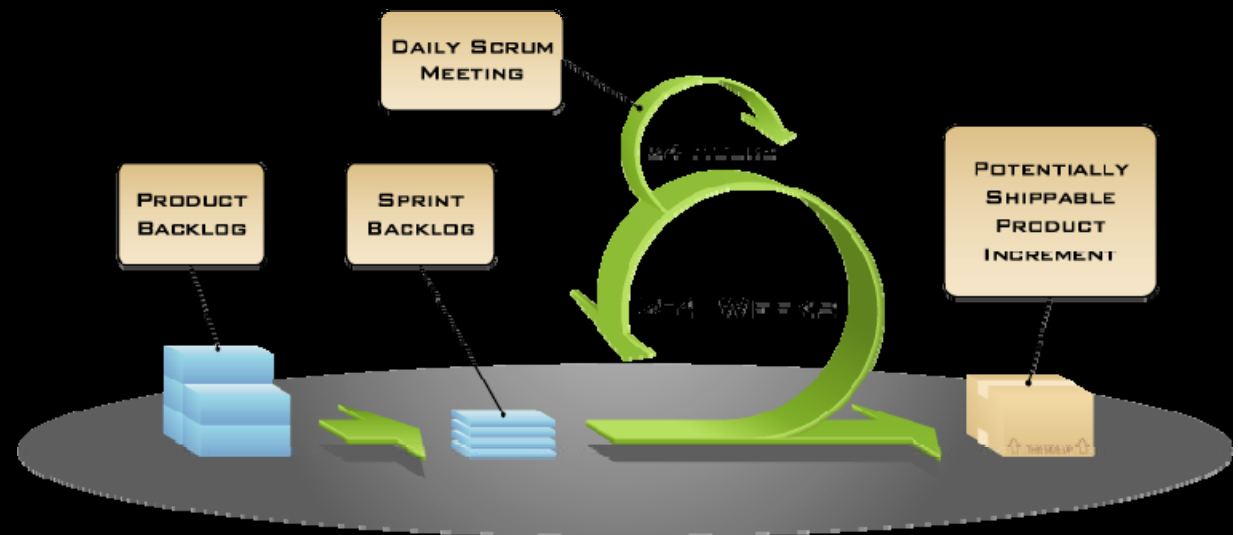
# Videogame development roles

- Management / personnel
- Game design
- Art / visual design
- Sound / music
- Level design
- Technical / programming / engine
- QA / testing
- Marketing / merchandising
- IT support
- R&D



# Videogame development projects

- Managed as large-scale software projects
- AAA-project ~ 15M Euro
- ~60% is spent on content creation
- 30-80 persons per project
- Agile development
- Outsourcing

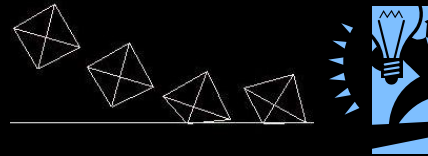


# Game engine components

Editor/Tools	Game-specific systems
	High-level systems
	Low-level systems
	Base



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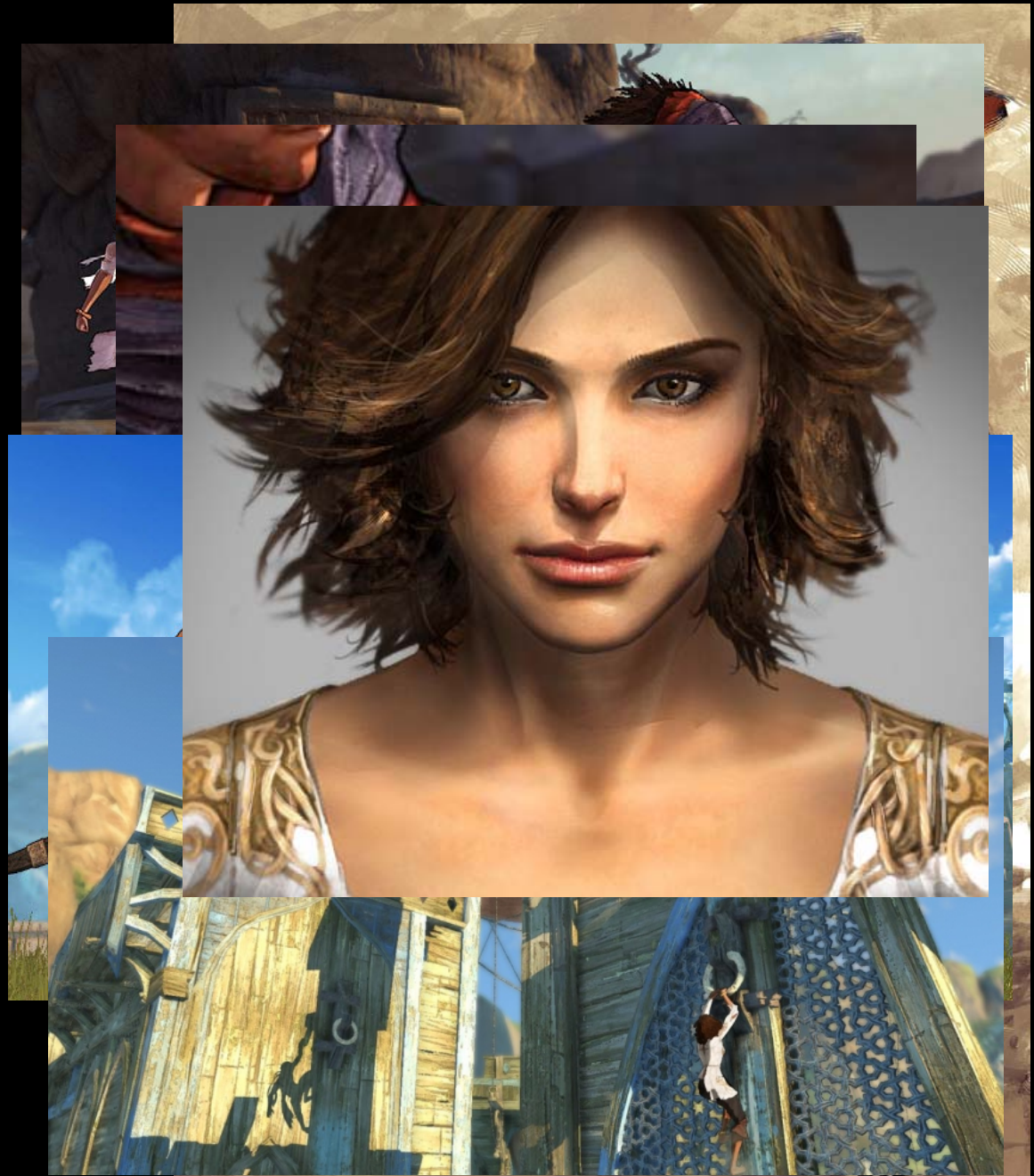


$$q = w + x\mathbf{i} + y\mathbf{j} + z\mathbf{k} = \cos\left(\frac{\alpha}{2}\right) + \mathbf{u} \sin\left(\frac{\alpha}{2}\right)$$

$$\mathbf{v}' = q\mathbf{v}q^{-1}$$

# Content

- Design
- Models
- Materials
- Textures
- Environments
- Characters
- Sound, dialogue

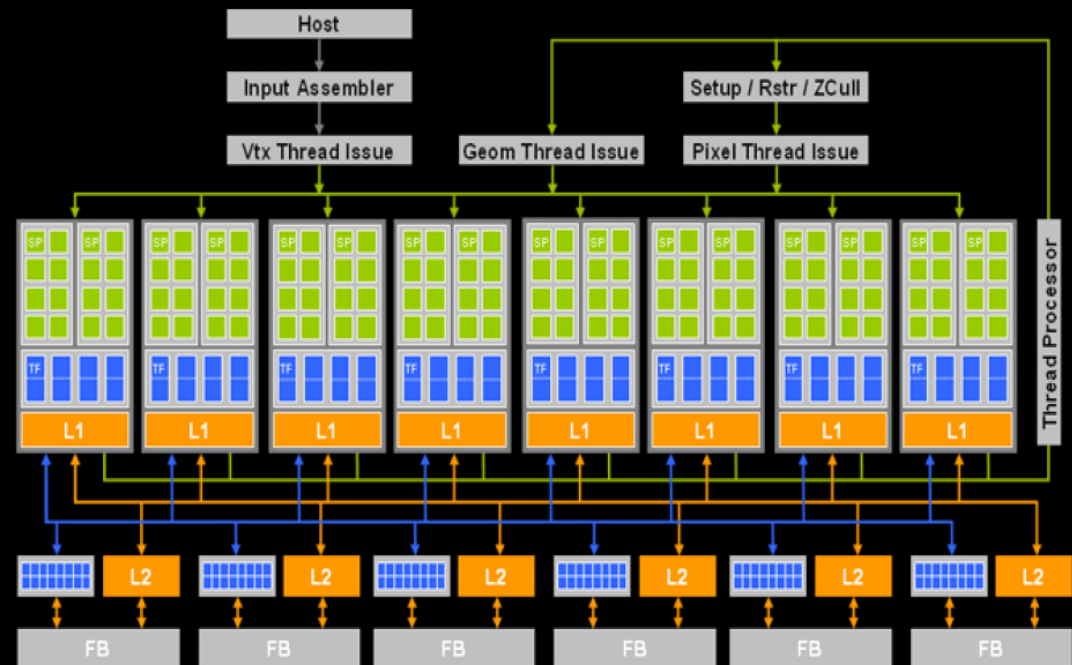


# Middleware - examples

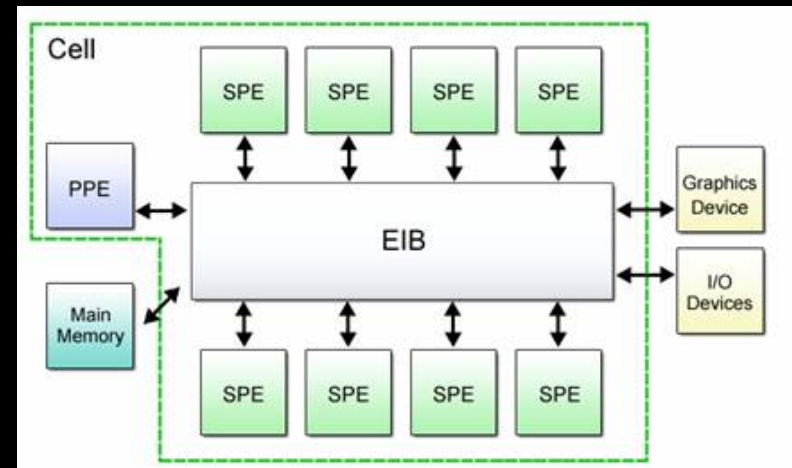
- **Game engines**
  - Unreal Engine
  - CryEngine
- **Physics**
  - Havok
  - PhysX
- **Animation**
  - NaturalMotion Morpheme
  - RAD Tools Granny
- **GUI**
  - Scaleform GfX
  - Menus Master
- **Sound**
  - FMod
  - GameCODA
- **Network solutions**
  - DemonWare
  - Sega NAP
- **AI**
  - Kynapse
  - Simbionic
- **Lighting**
  - Geomerics
  - Beäst

...and many more!

# An exciting time to develop games...

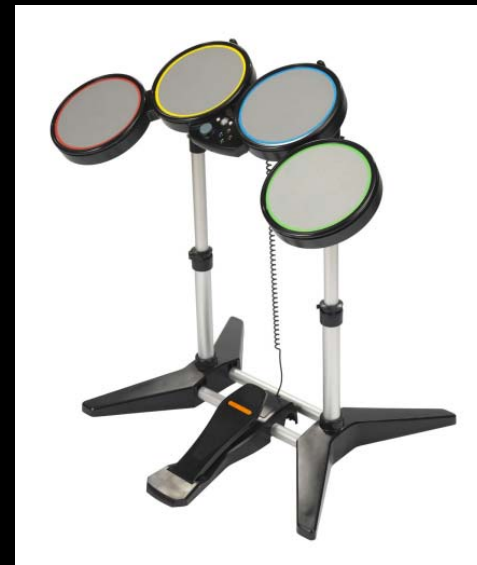


# An exciting time to develop games...





# An exciting time to develop games...





# **The basics of videogame graphics**



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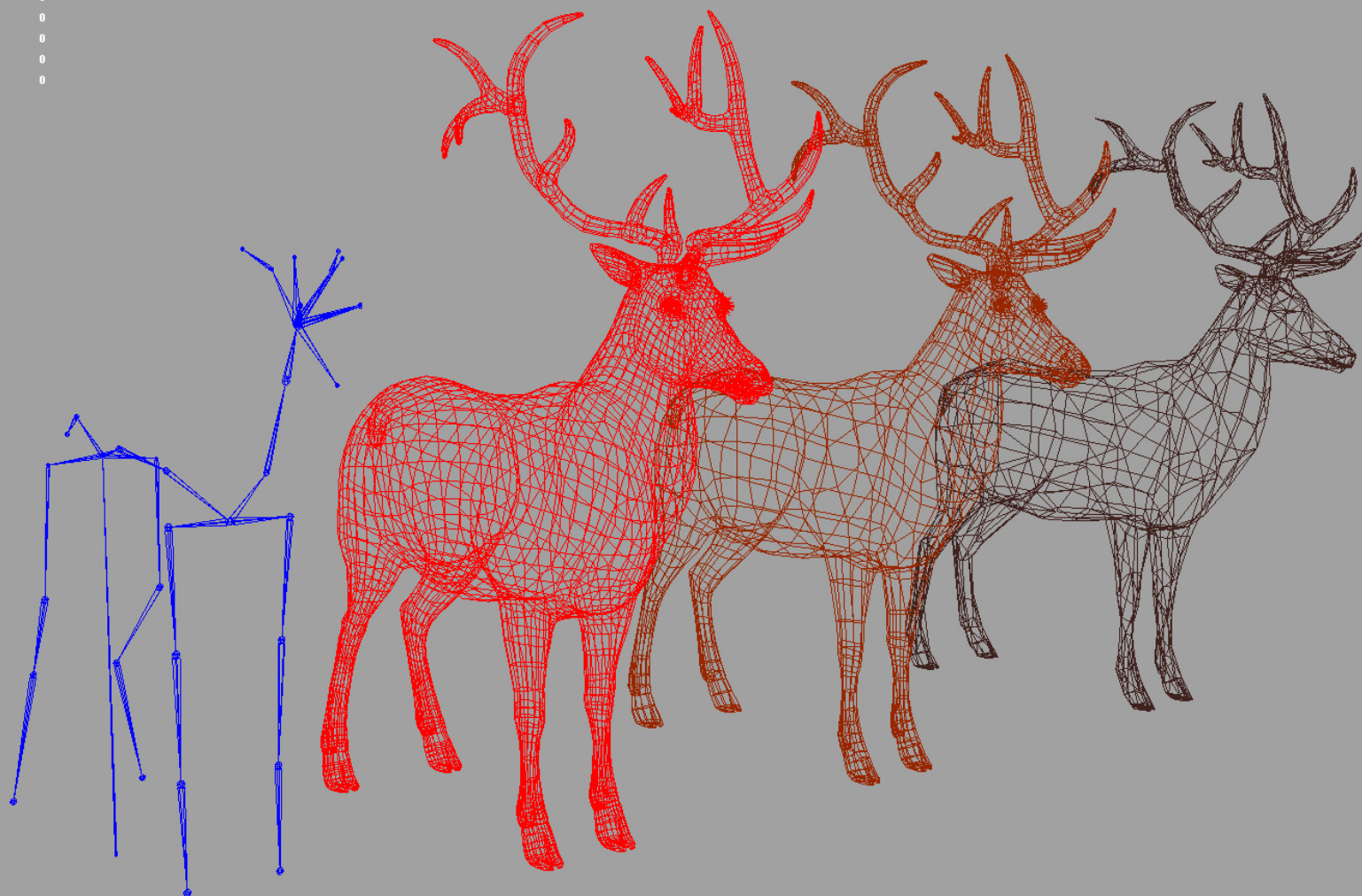
Wikipedia

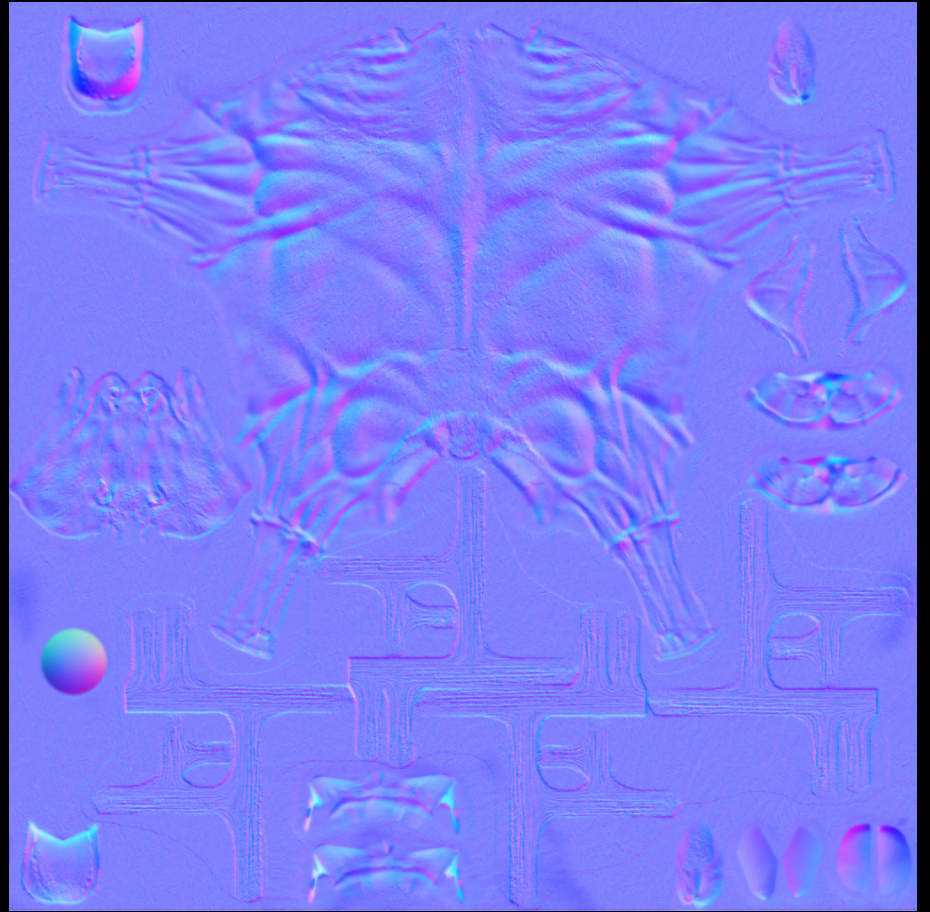


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Verts: 11073 0 0  
Edges: 23112 0 0  
Faces: 12060 0 0  
Tris: 21931 0 0  
UVs: 13158 0 0

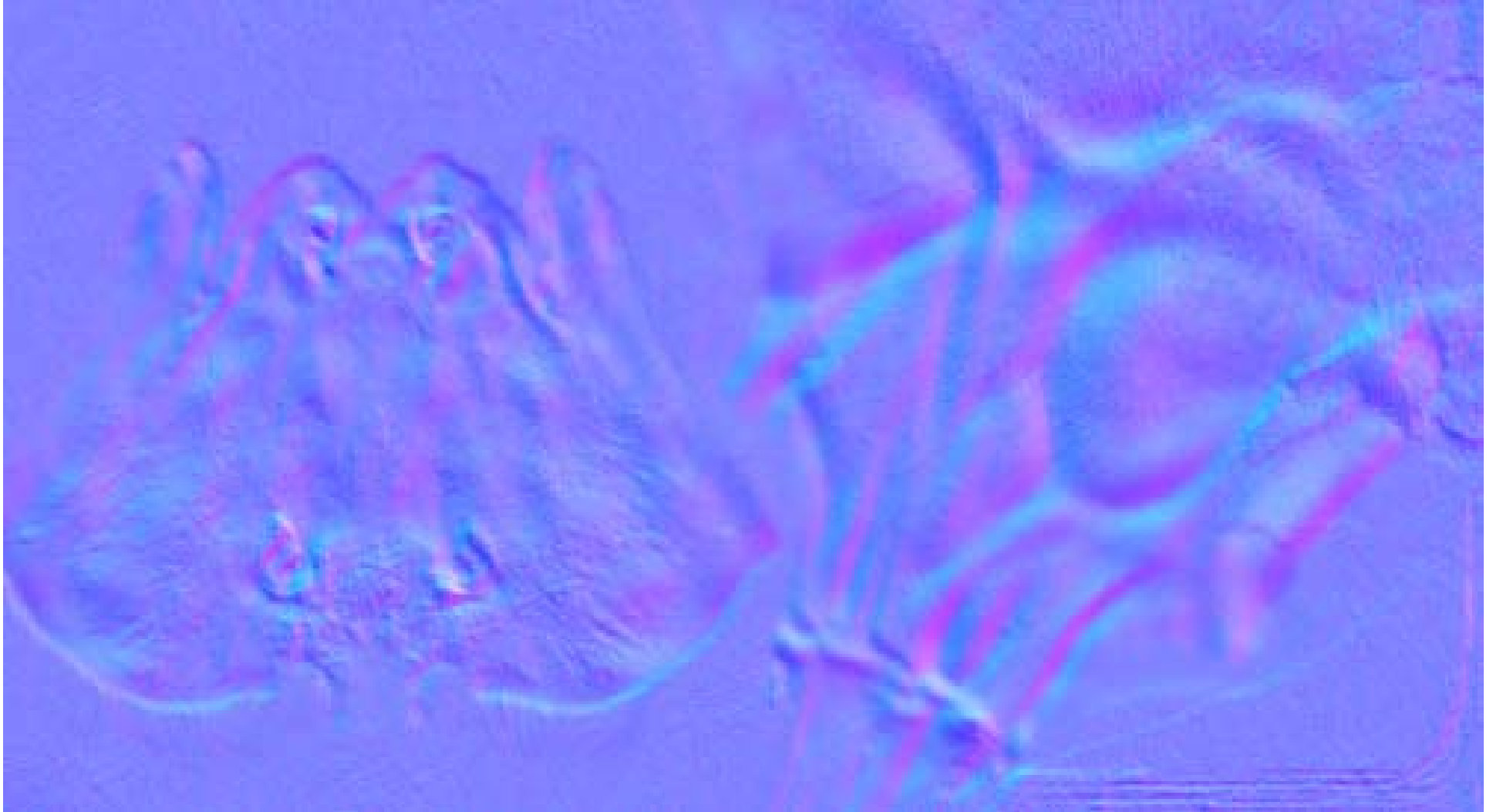




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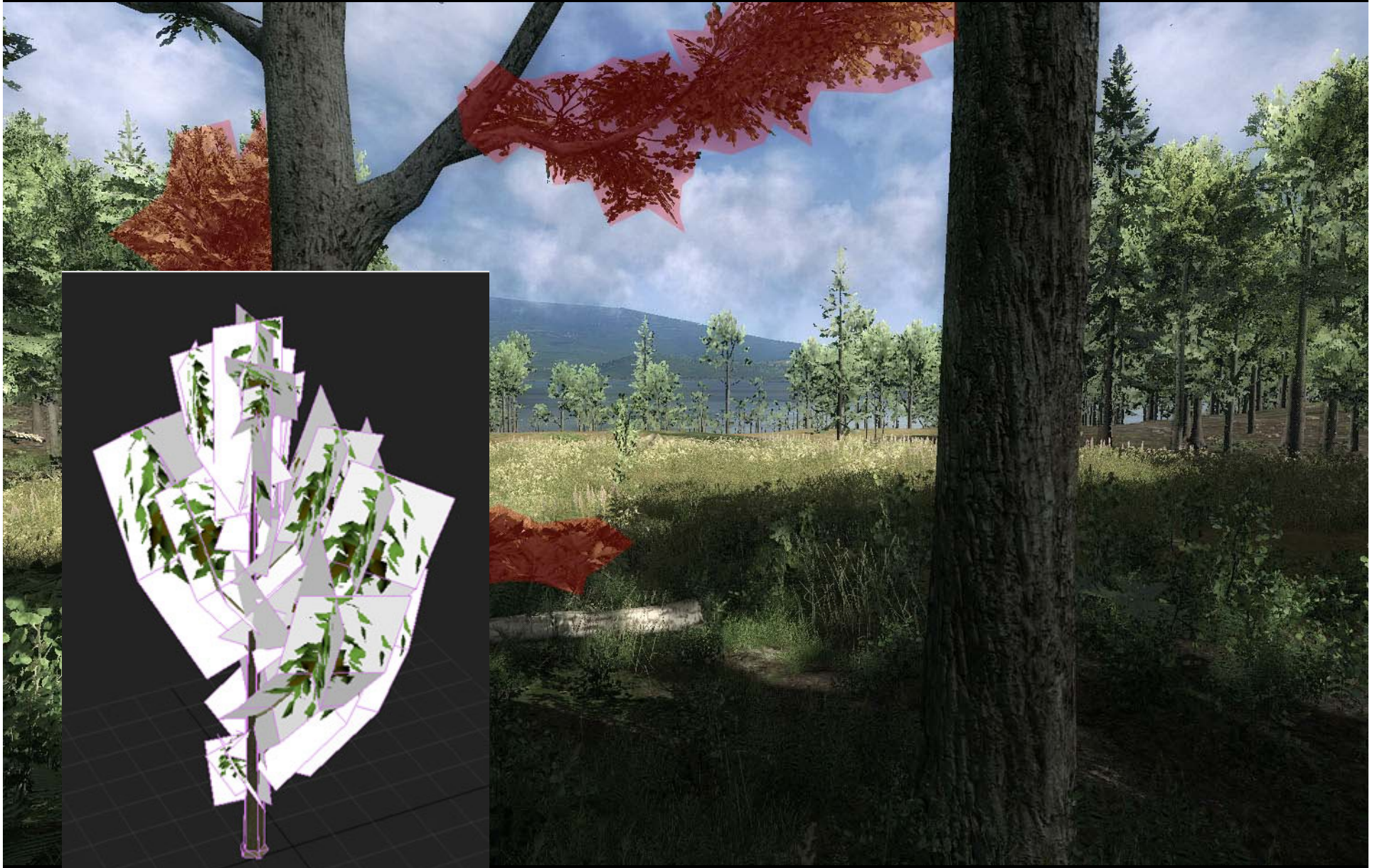








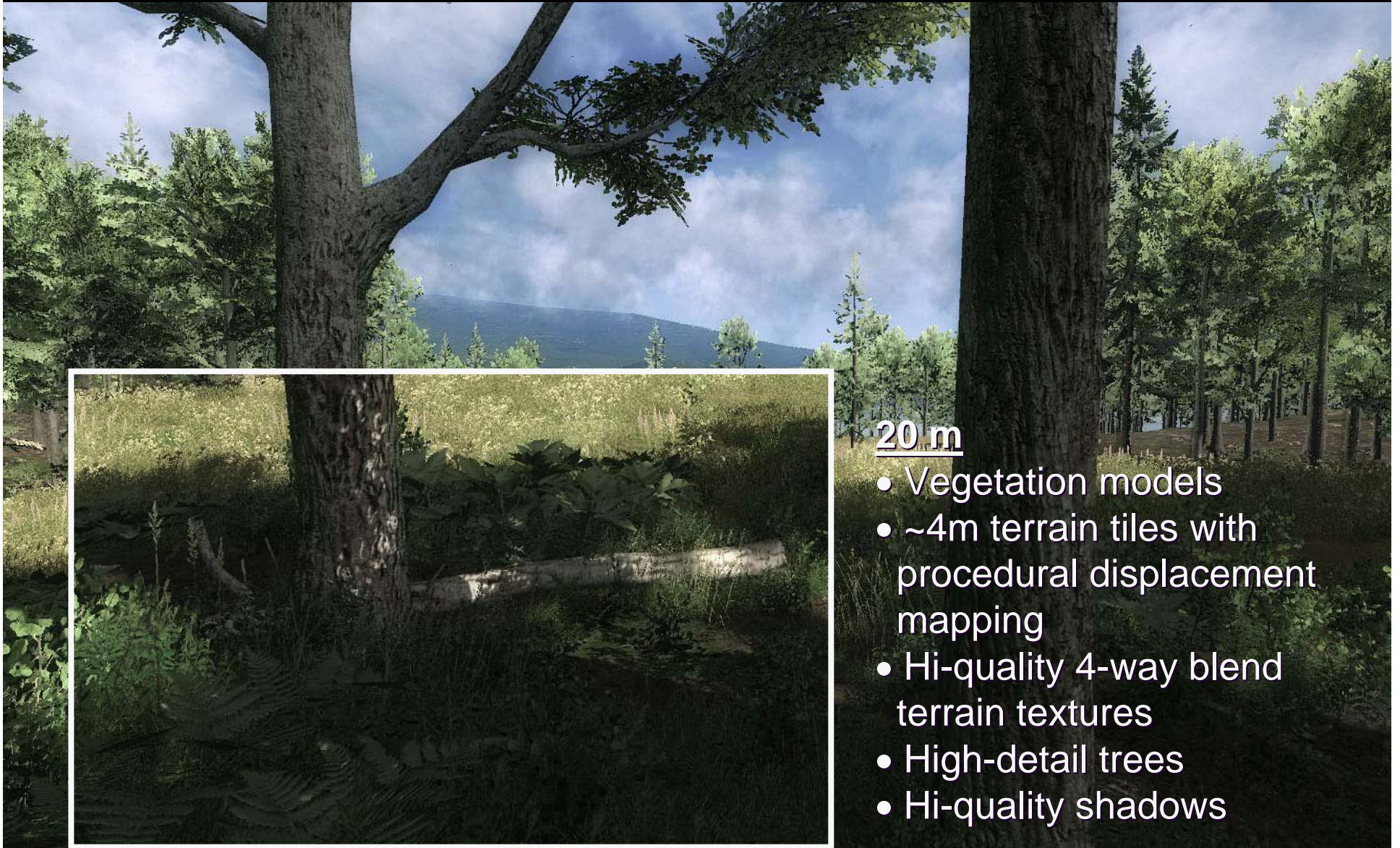




[http://www.cgarchitect.com/news/Reviews/Review011\\_1.asp](http://www.cgarchitect.com/news/Reviews/Review011_1.asp)

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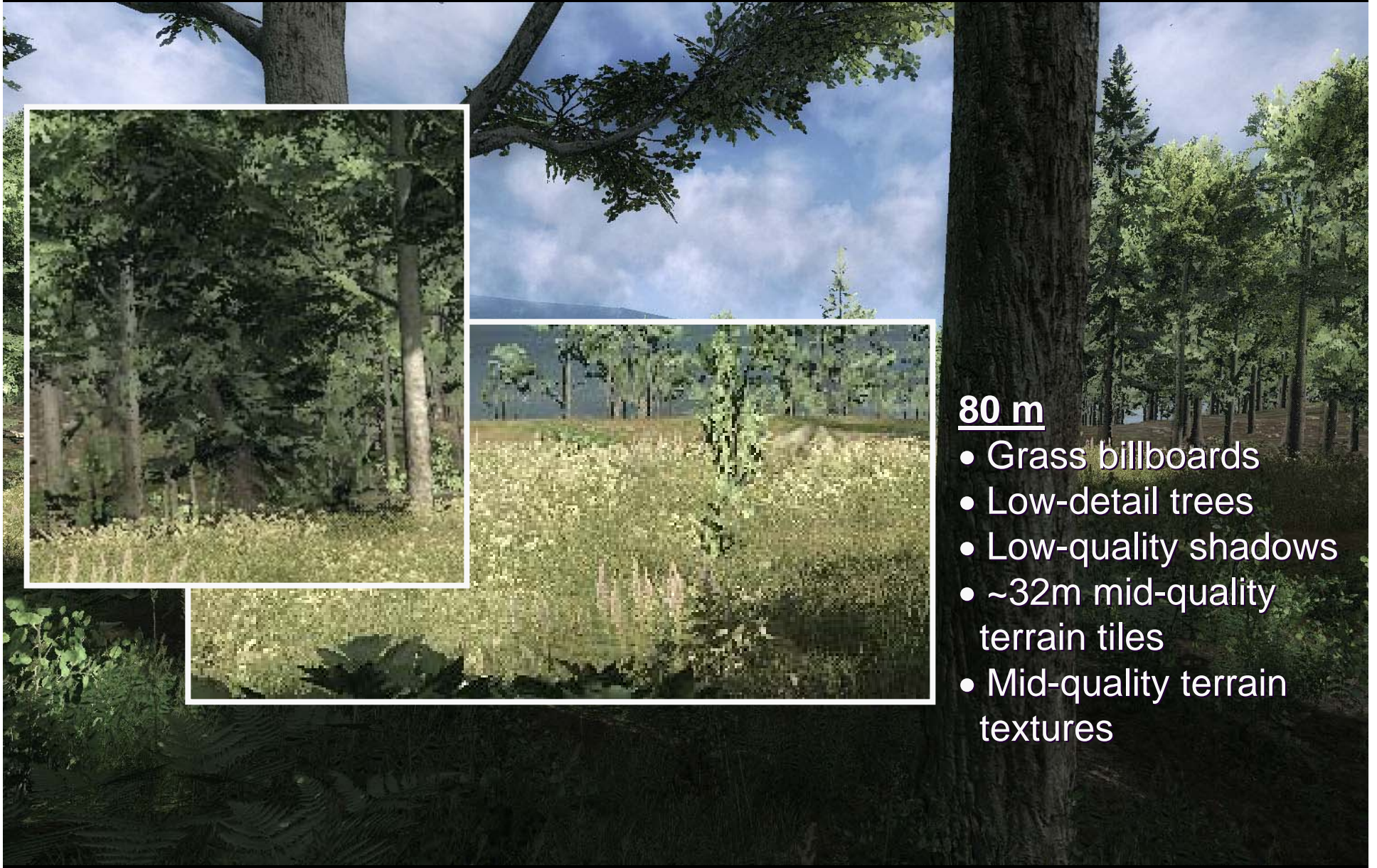




20 m

- Vegetation models
- ~4m terrain tiles with procedural displacement mapping
- Hi-quality 4-way blend terrain textures
- High-detail trees
- Hi-quality shadows





### 80 m

- Grass billboards
- Low-detail trees
- Low-quality shadows
- ~32m mid-quality terrain tiles
- Mid-quality terrain textures

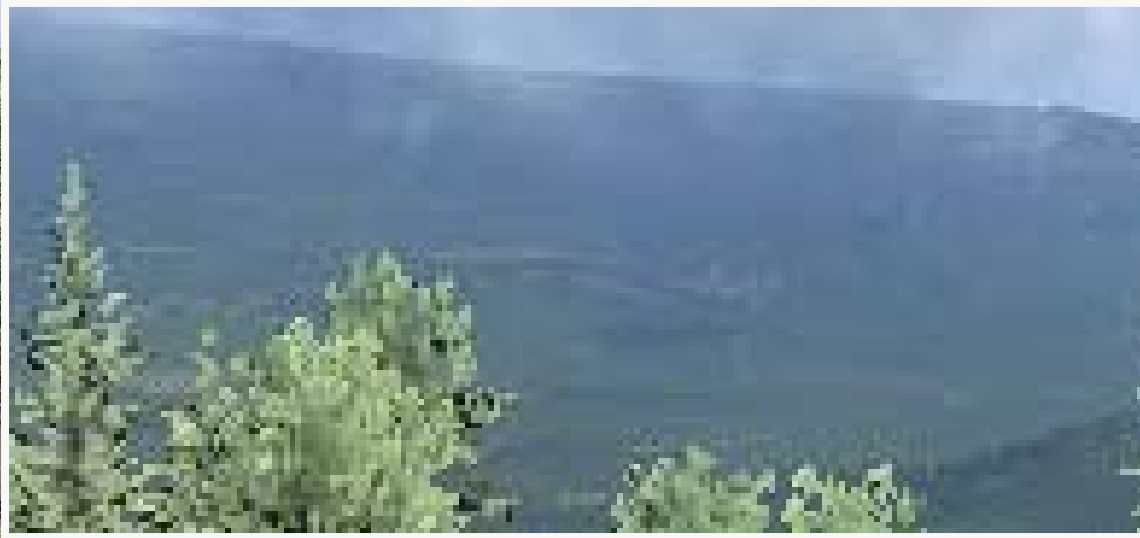




### 100 m

- Tree billboards
- ~64m mid-quality terrain tiles
- Low-quality terrain textures





### Beyond 100 m

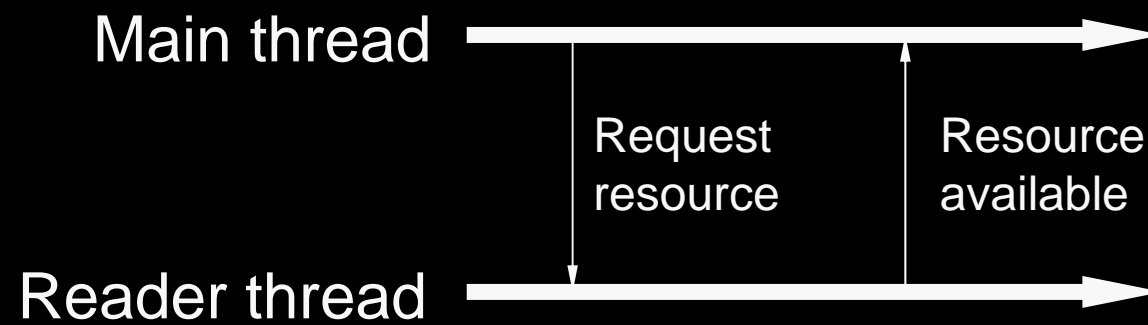
- ~128m low-quality terrain tiles
- Global terrain texture

# Game data lifetime

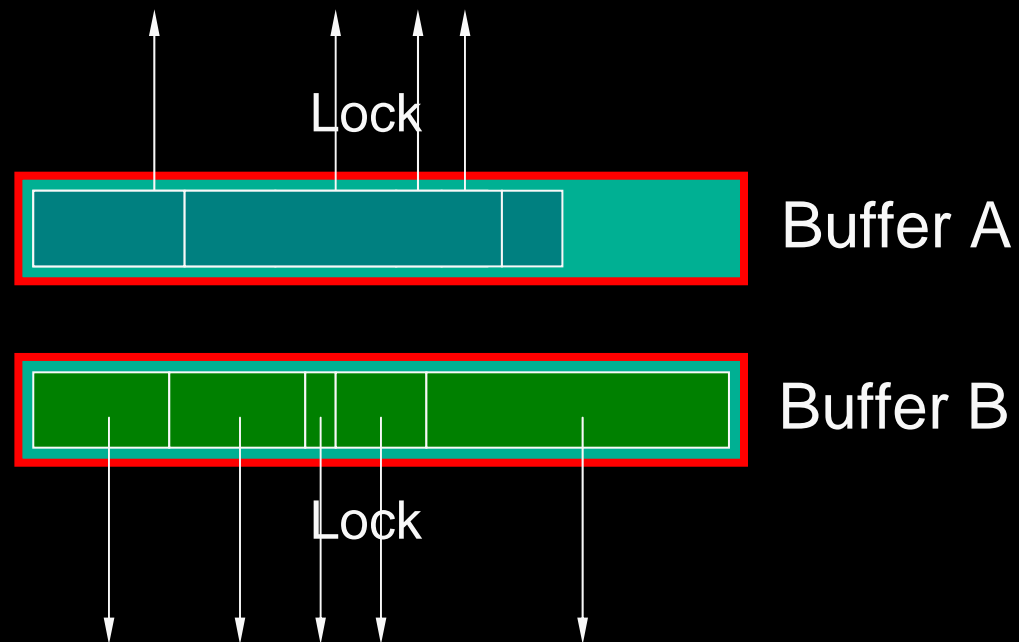
- Persistent data – loaded to RAM on game start
- Location data – loaded based on camera position
- Event data – cutscenes, full-screen GUIs, etc.

# Data streaming

- DVD
  - 8.5 GB (dual layer)
  - Seek time ~100 ms
  - Data rate ~10 MB/s
- One seek  $\leftrightarrow$  load 1 MB data
- Minimize the number of seeks: optimize the DVD layout
- Asynchronous streaming



Game System



Buffer A

Buffer B

Game System



Presented by Masaki Kawase.  
<http://www.daionet.gr.jp/~masa>





[http://edusworld.org/ew/ficheros/2006/paginasWeb/making\\_of\\_sotc.html](http://edusworld.org/ew/ficheros/2006/paginasWeb/making_of_sotc.html)





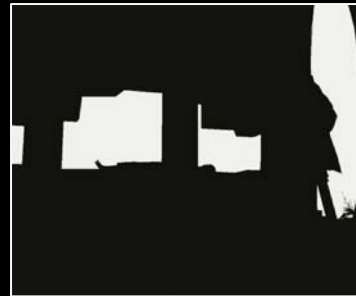
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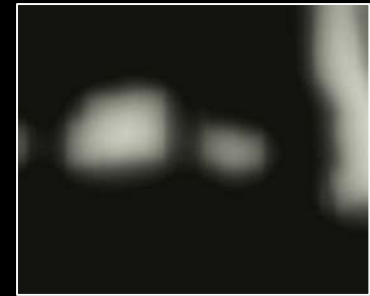
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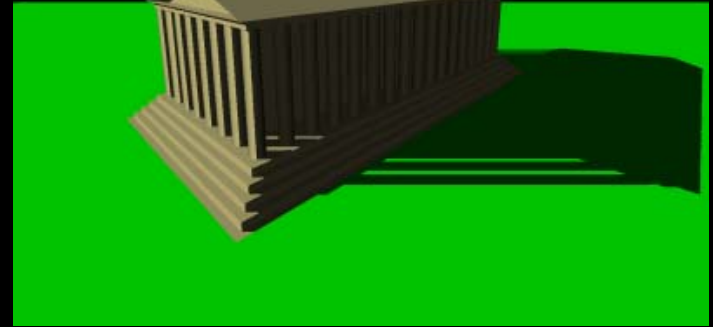
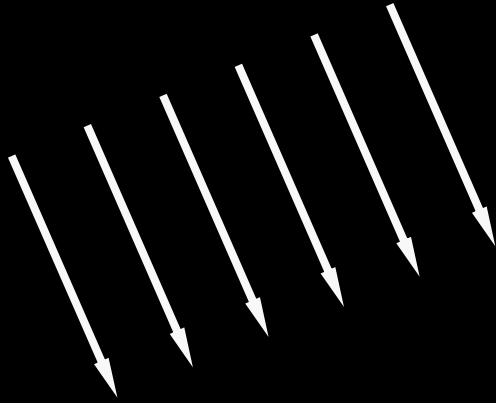


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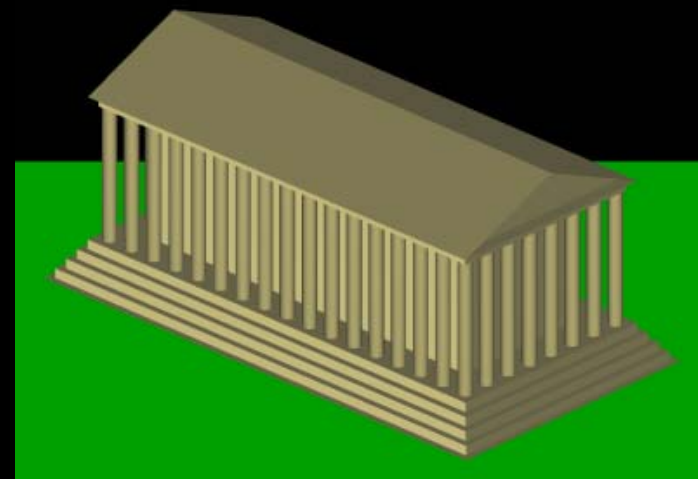
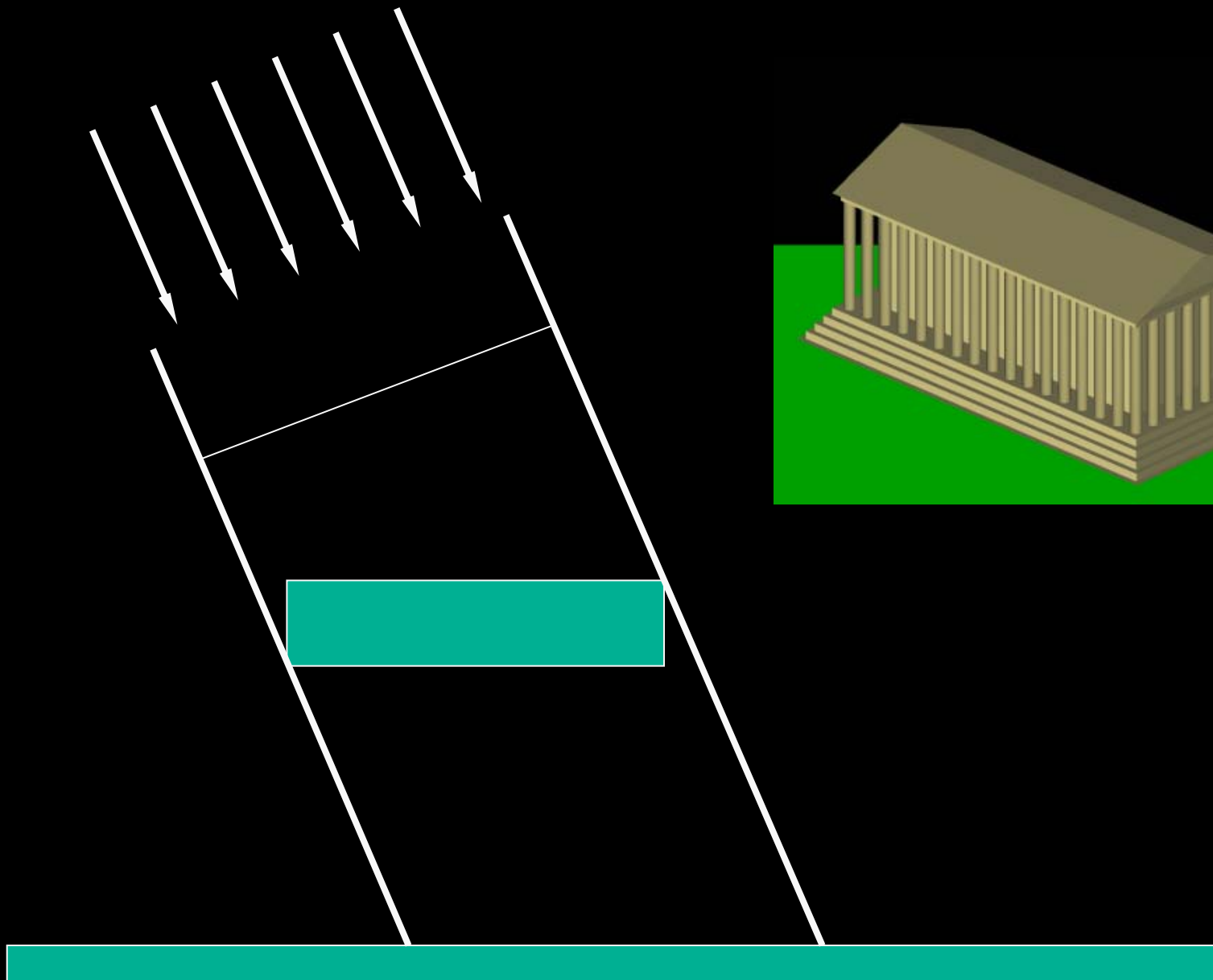




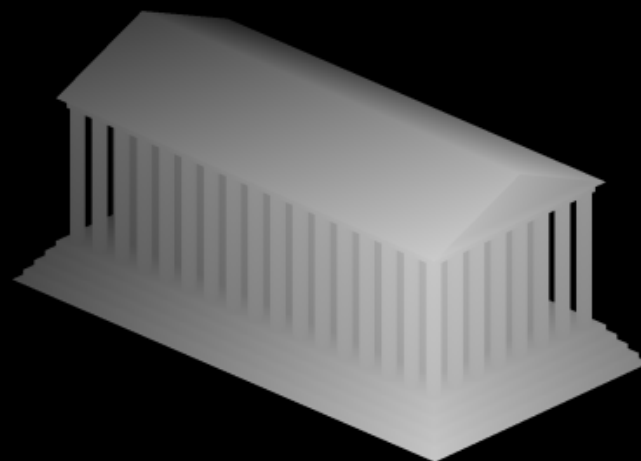
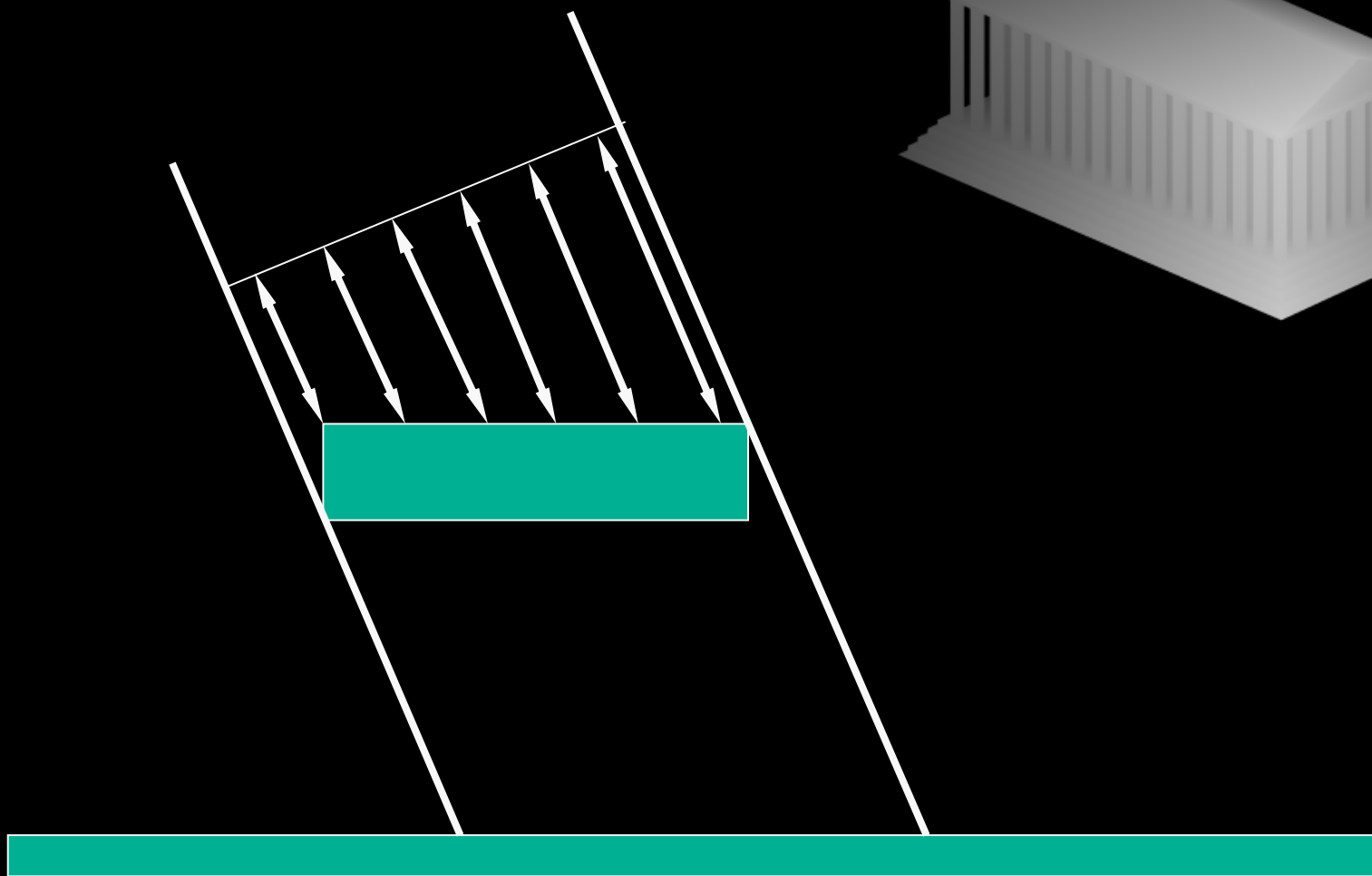


Wikipedia



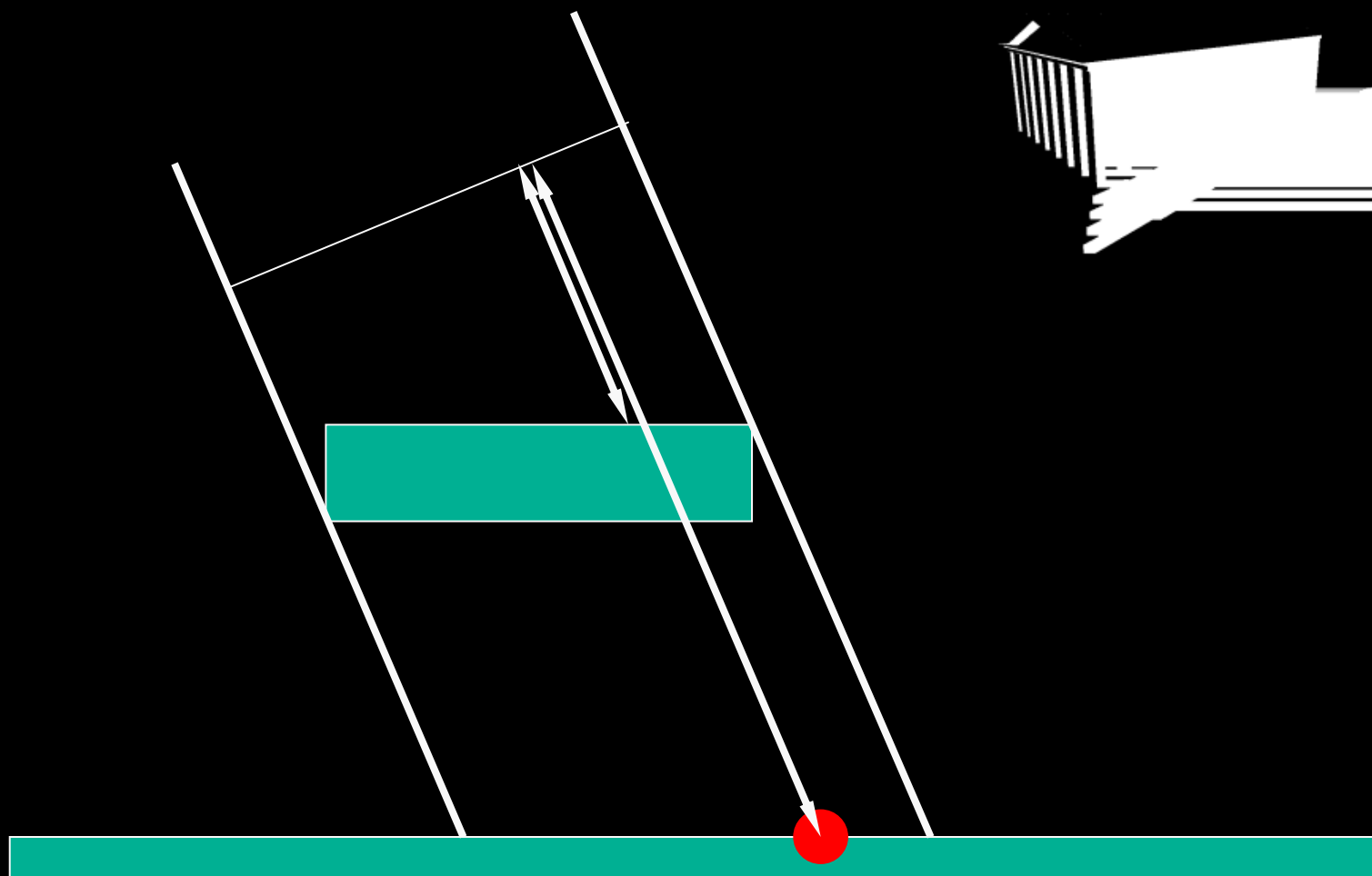


Wikipedia



Wikipedia





Wikipedia



[http://developer.nvidia.com/object/hwshadowmap\\_paper.html](http://developer.nvidia.com/object/hwshadowmap_paper.html)



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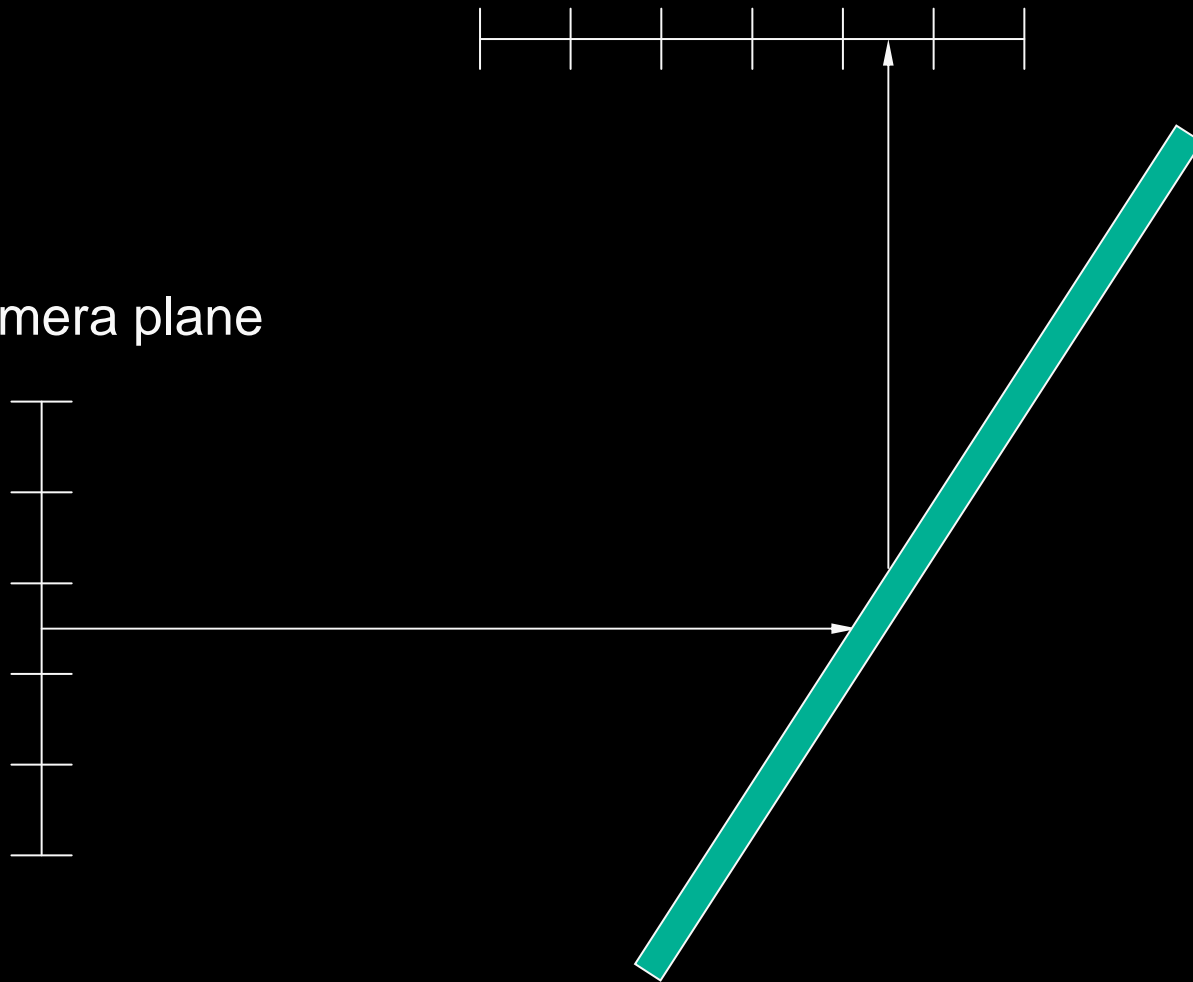


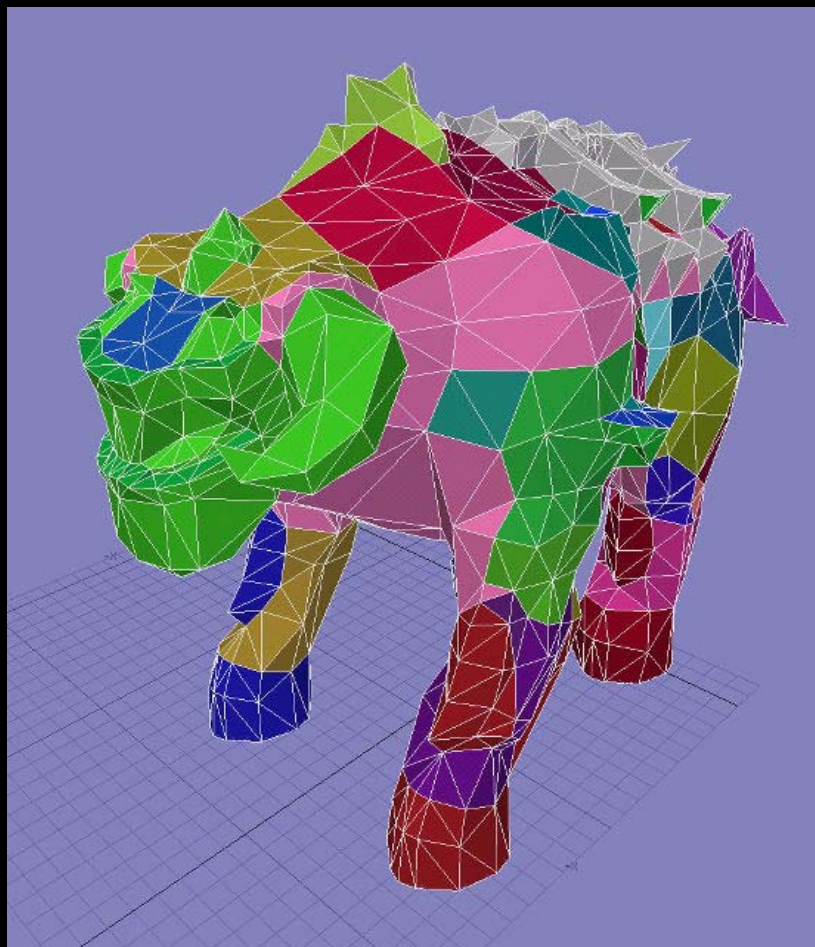
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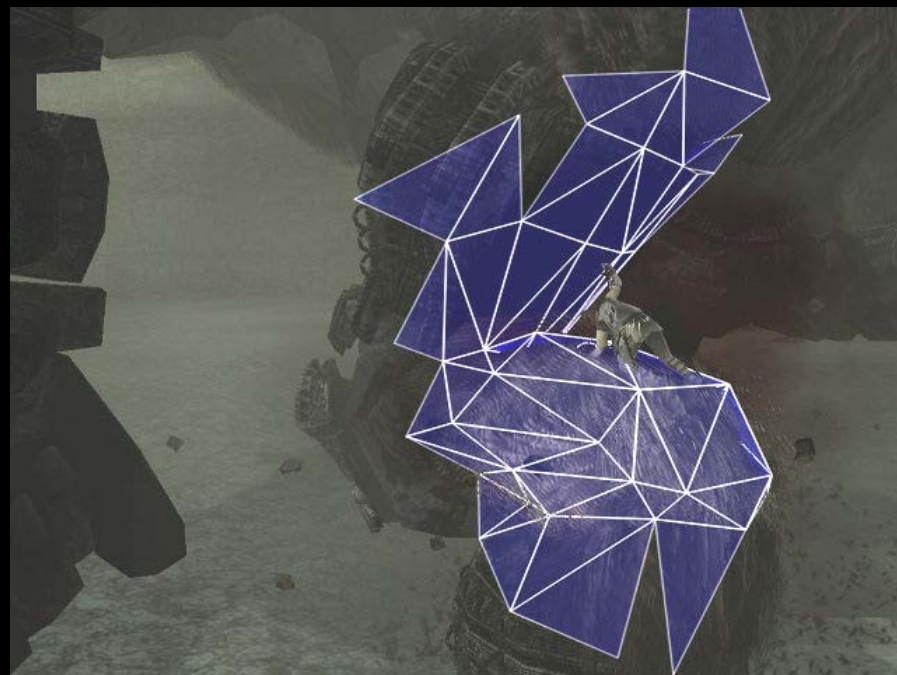
Eye camera plane

Light camera plane

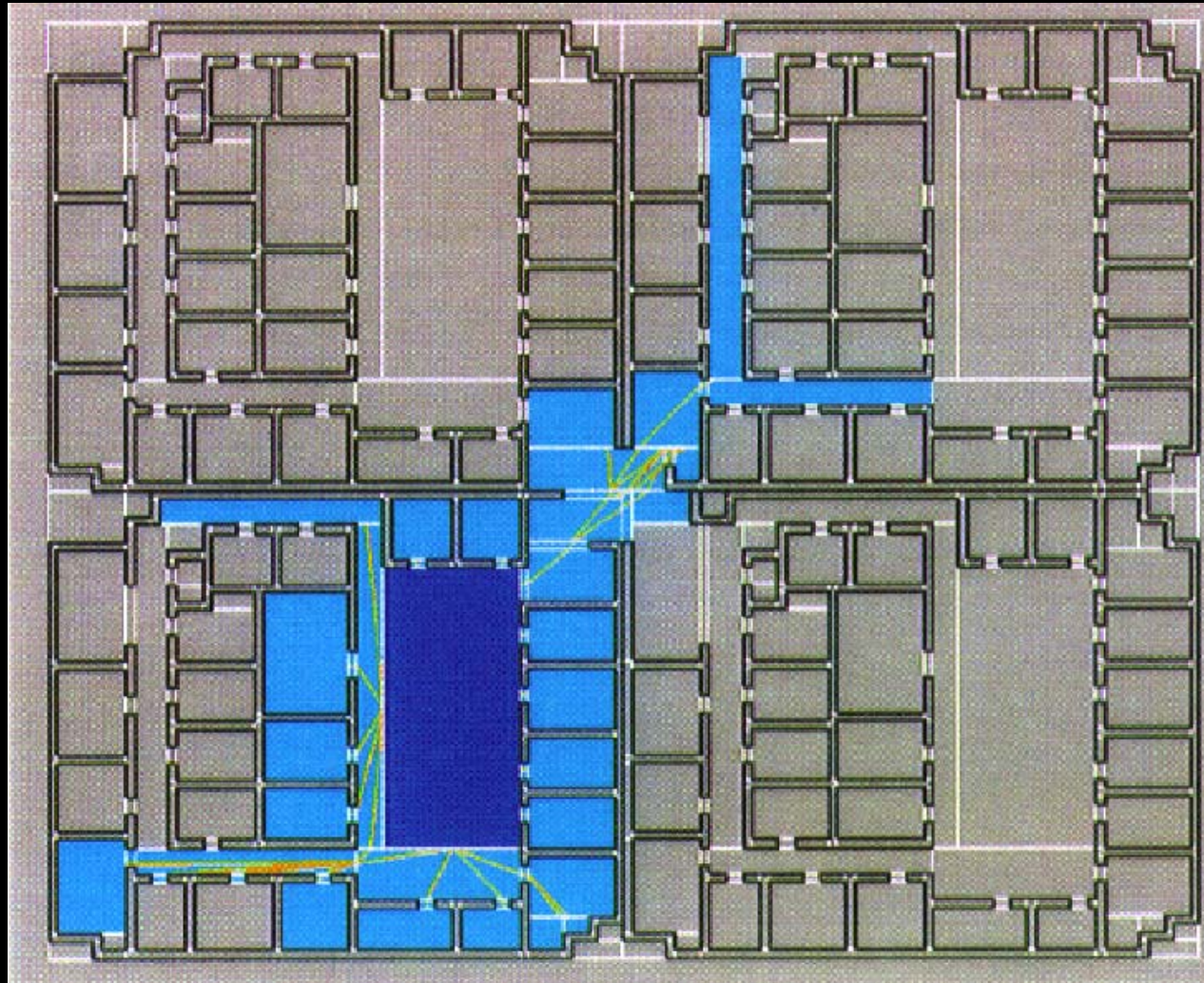




[http://edusworld.org/ew/ficheros/2006/paginasWeb/making\\_of\\_sotc.html](http://edusworld.org/ew/ficheros/2006/paginasWeb/making_of_sotc.html)







<http://graphics.lcs.mit.edu/~seth/pubs/pubs.html>





# Summary

- Videogame graphics is **design-driven**
- Artistic vision in combination with performance requirements
- Simplify real-world phenomena
- Only draw what you have to
- Precompute as much as possible
- Level-of-detail

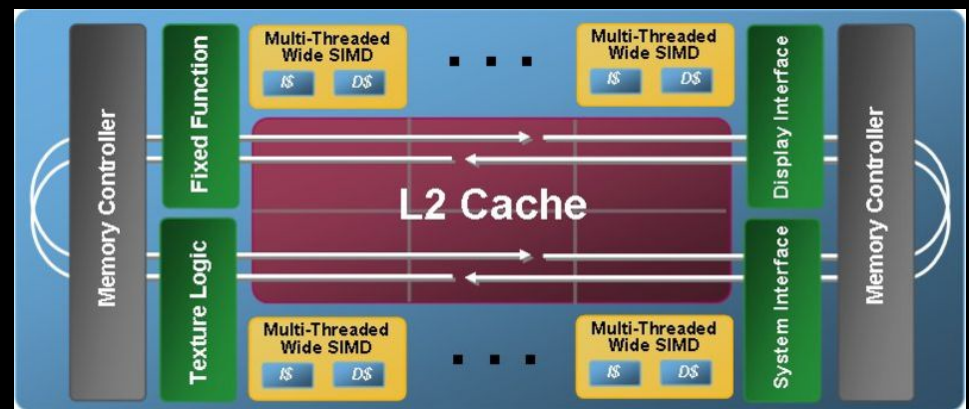
# Summary

- Videogame development requires a large number of roles
- Advanced algorithms
- Based upon the latest research
- Trade-off between performance and audiovisual quality



# Summary

- Parallel – multicore
- More storage
- Limited access times to memory and storage
- Algorithmically generated content



Wikipedia

# Wanna be a games programmer?

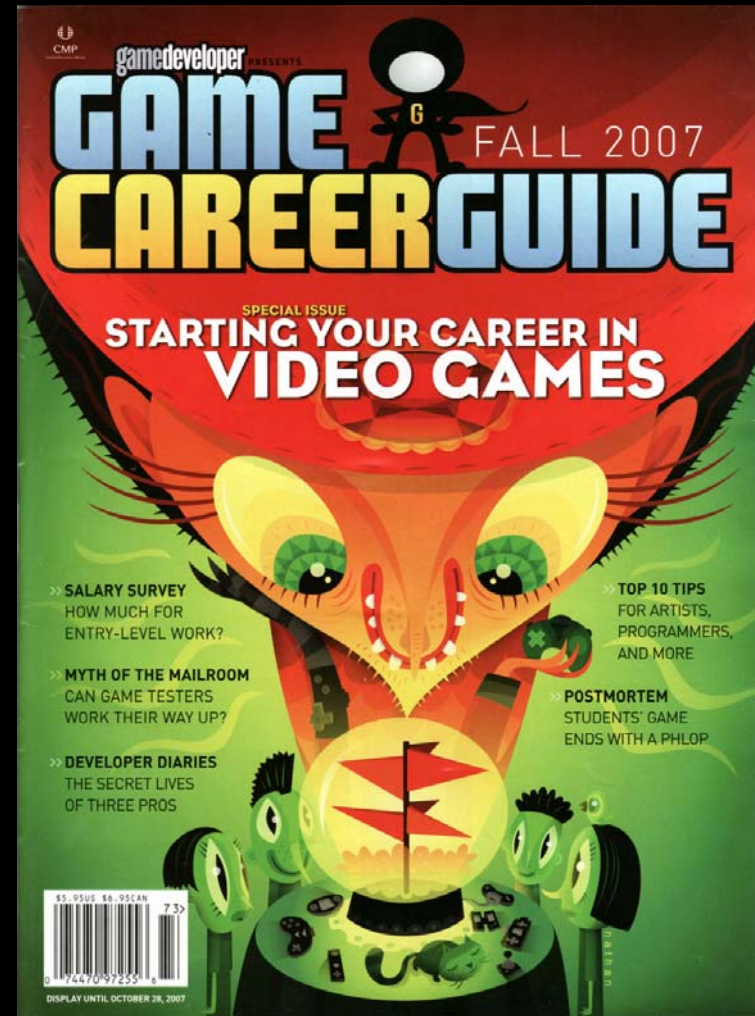
- C++
- Able to work focused
- Optimization
  - Memory-, real-time-, platform specific-, choice of algorithms
- Low level programming
- Efficient debugging
- Design patterns
- Windows programming



<http://www.gamesetwatch.com/gd-0706.jpg>

# Wanna be a games programmer?

- Practice
- Performance, performance, performance!
- Expertise, deep knowledge
- Parallel systems (Cell, Multicore-PC)
- Shading (Cg, HLSL)
- DirectX 11, Pix



<http://www.gamesetwatch.com/gd-2007careerguide.jpg>



Spurred by powerful Prothean artifacts, Humanity has made tremendous technological progress in almost every area.



Except elevators.



The Protheans died out over fifty thousand years ago. No-one is really sure where they went, but we have a theory:



MAYBE THEY ALL DIED IN ONE OF THEIR SLOW-ASS STUPID FUCKING ELEVATORS

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