

State of the Art Rendering Techniques on Portable Devices

Készítette

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Konzulens

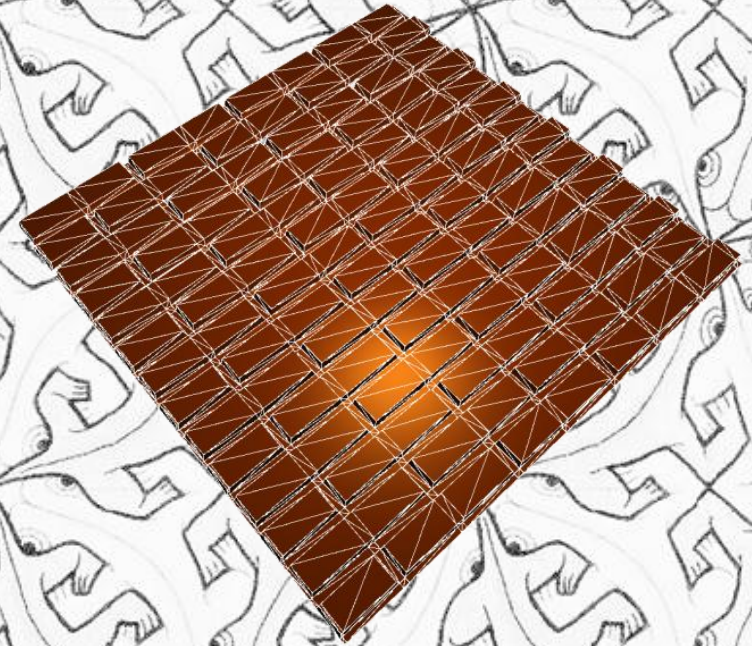
Rajacsics Tamás
Tanársegéd

Motivation

Portable devices...	User	Developer
are quite popular	fashionable	profitable
are more user friendly	fun	different
are more accessible	easy to use	diverse audience
are mobile	can use it anywhere	new potentials
have a broad and competitive market	room for choice	interesting
getting better hardware acceleration	faster & cooler	only a few years behind
need imagination	new ways to use	design
have limitations	PC remains too	old/new tricks

Limitations

- Limited access func.
- Shared resources
- Small screen
- Seperate GPU thread
- Special dev. enviroment



Manufacturer & Model	CPU	GPU
NVidia Tegra 3	4 x 1.2–1.6 GHz	8 x 416–520 MHz
Apple A6	2 x 1.3 GHz	3 x 200 MHz
Samsung Exynos	4 x 1.4–1.6 GHz	4 x 240–395 MHz

Basic texturing

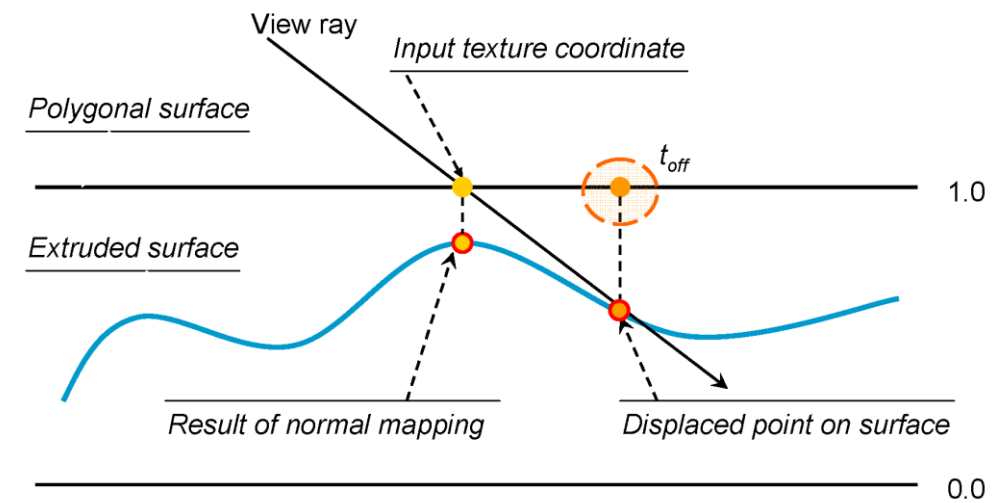
Normal mapping



Parallax mapping

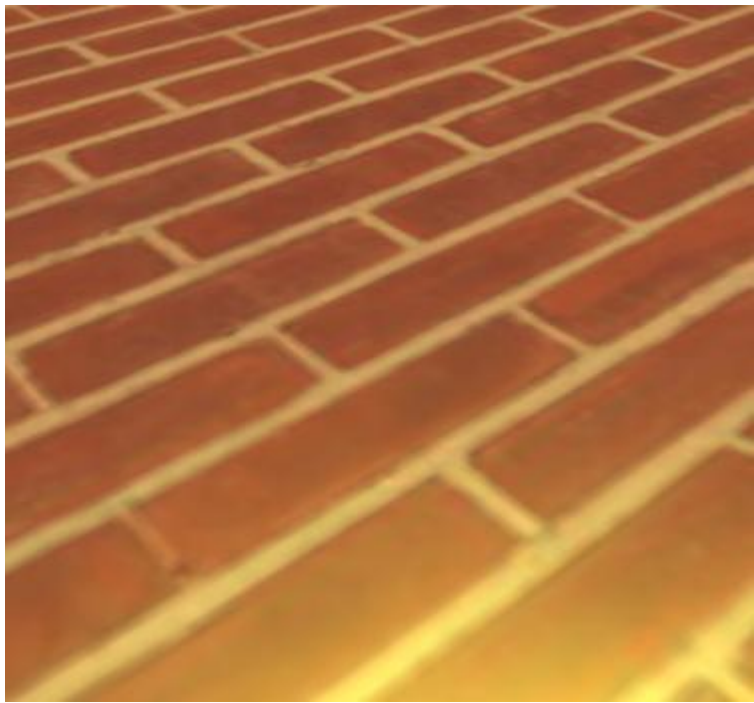
Parallax Occlusion Mapping

- Correct parallax
- Self-occlusion
- Self-shadows
- Simple
- One pass

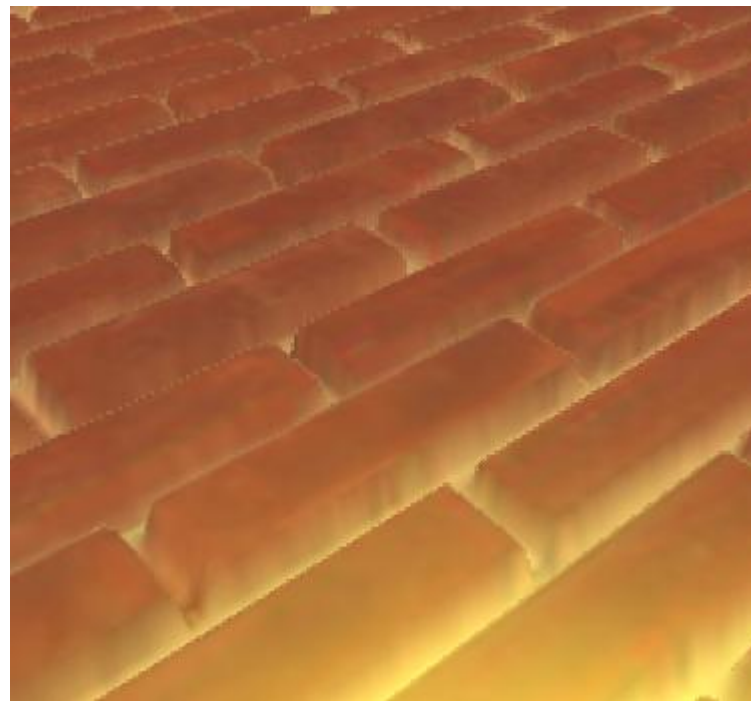


Height profile sampling

Whithout parallax

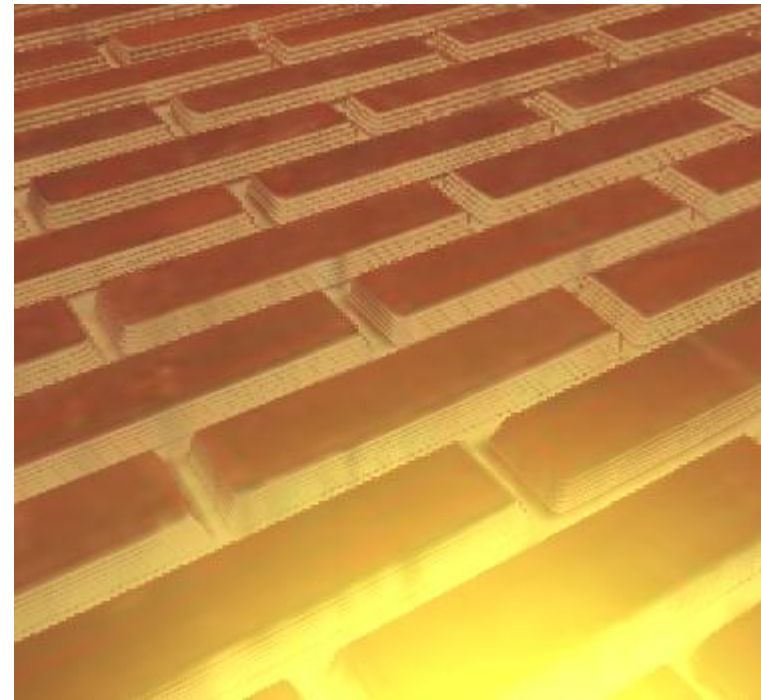


With parallax



Shortcomings of POM

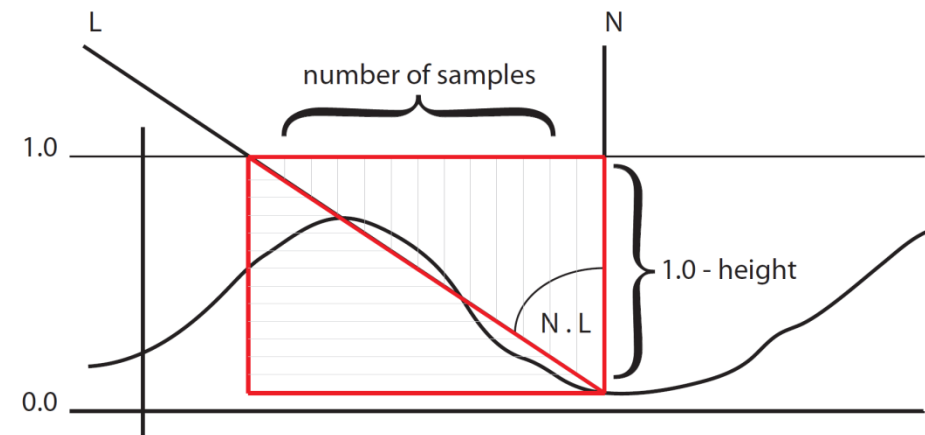
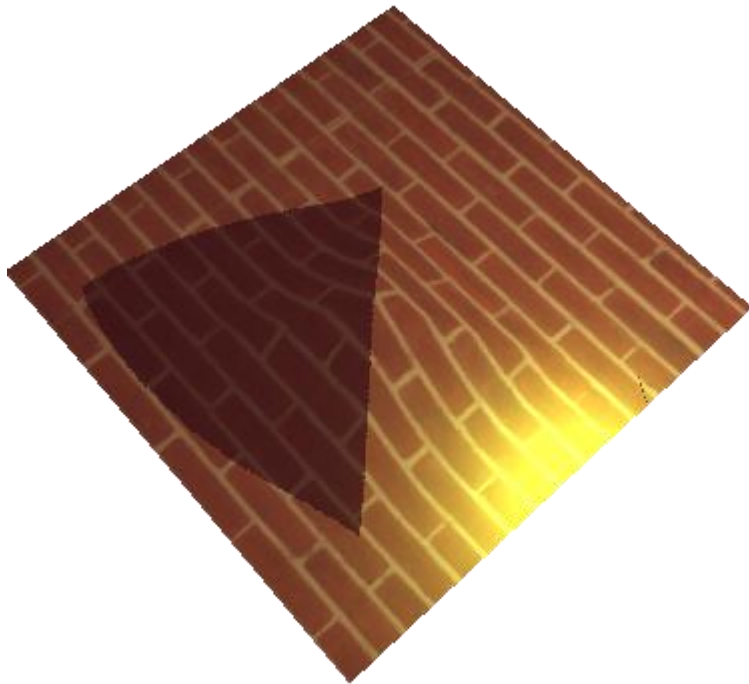
- Flattening
- Aliasing
- Texture overreading
- Texture reads should be optimized



Low sampling rates

Apprx. Self-shadows

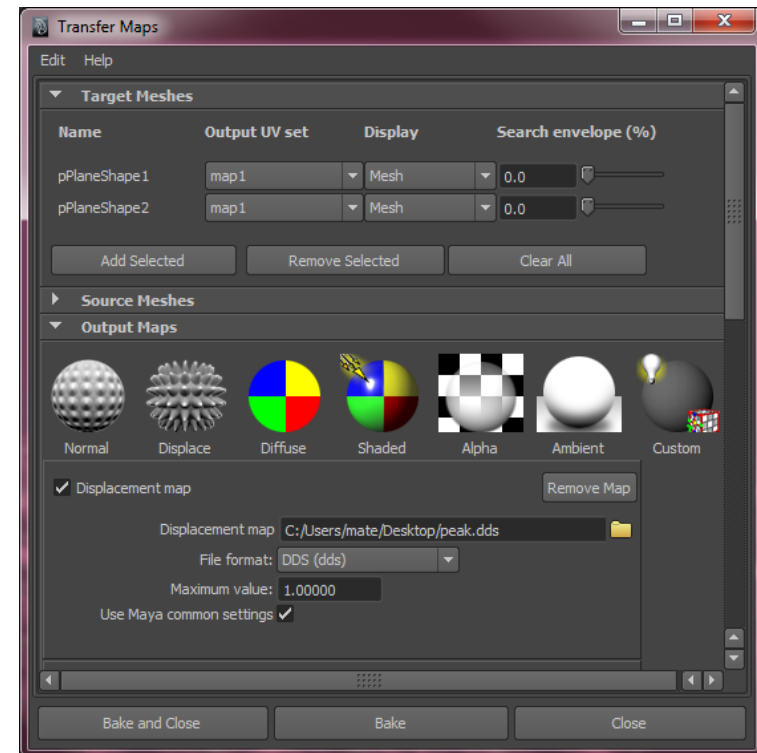
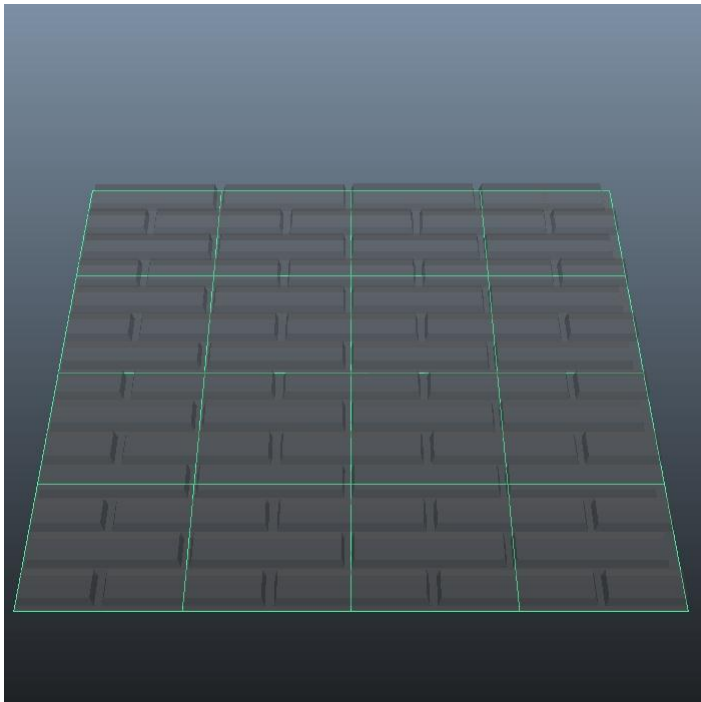
Self-shadow



Shadow sampling

Height map creation

Setup



Maya

Texture Compression

- Decoding speed
- Random access
- Compression rate
- Compression quality



ETC1

DXTn

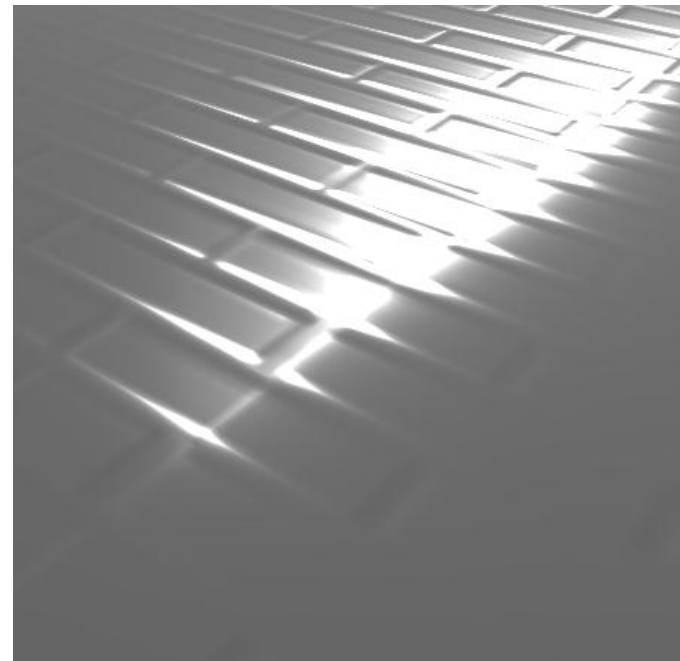
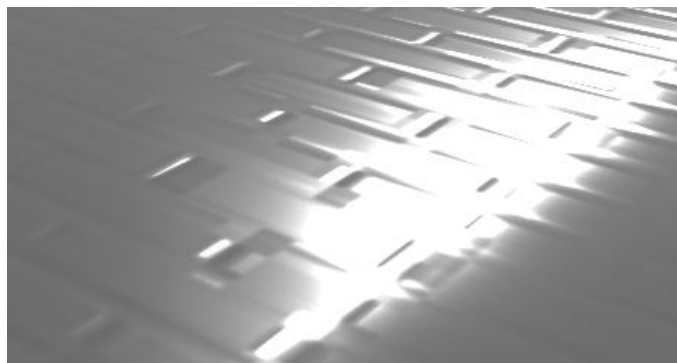
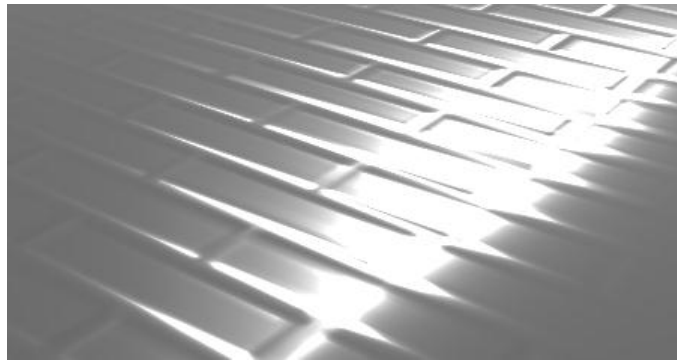
Uncompressed



DXT5

ATI2

Original & DXT1



ATI2

Fluid Simulation

Navier-Stokes equations

$$\frac{\partial \mathbf{u}}{\partial t} = -(\mathbf{u} \cdot \nabla) \mathbf{u} - \frac{1}{\rho} \nabla p + \nu \nabla^2 \mathbf{u} + \mathbf{f}$$

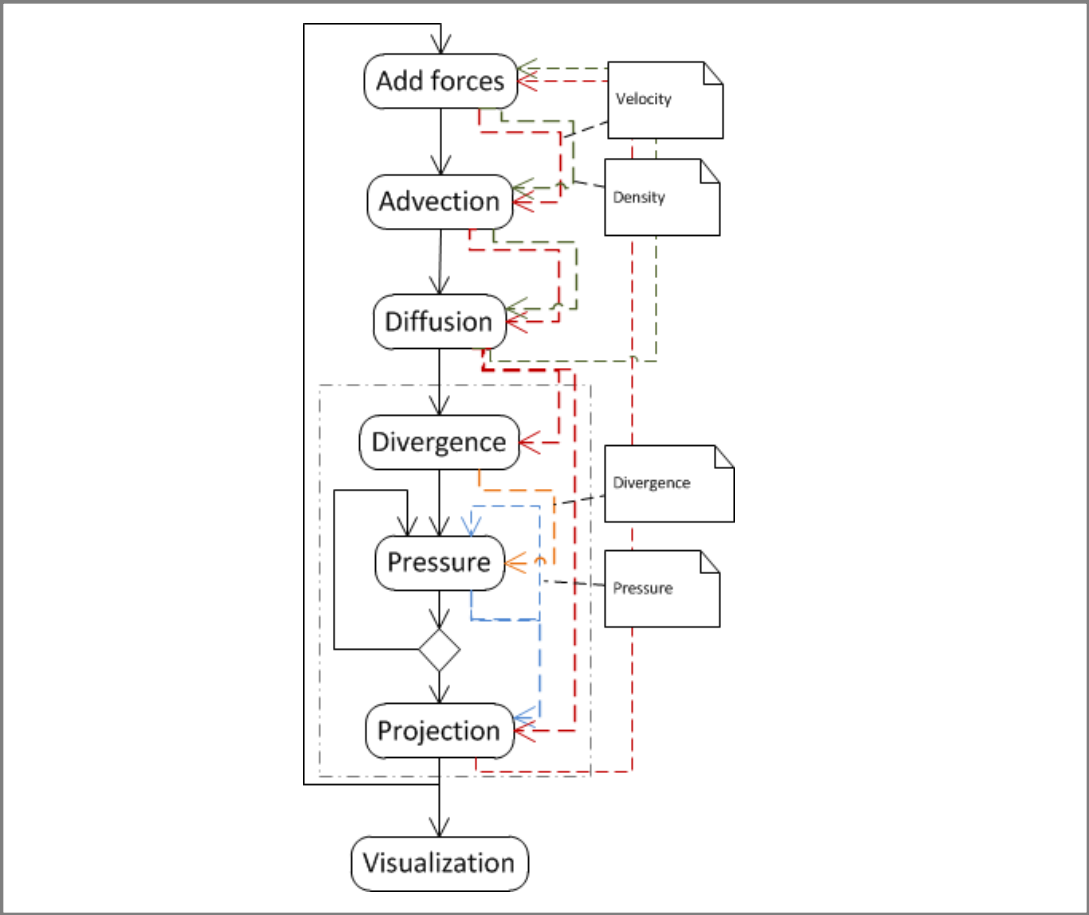
Helmholtz-Hodge
decomposition

$$\mathbf{S}(\mathbf{u}) = \mathbf{A} \cdot \mathbf{F} \cdot \mathbf{D} \cdot \mathbf{P}(\mathbf{u})$$

- Advection
- Pressure
- Diffusion
- Forces

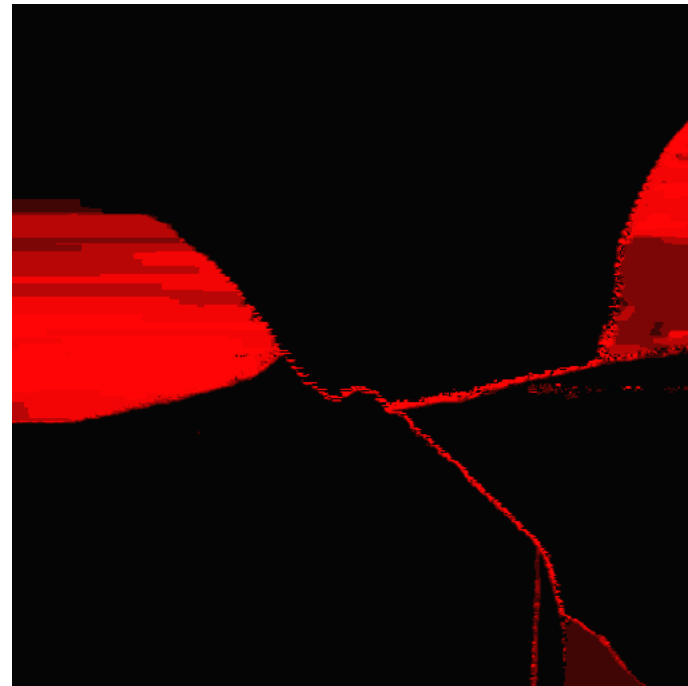
GPU implementation

- Extensive render target usage
- Numeric methods
- Iterative
- Can be incorporated into existing texture based methods



Buffers

Velocity



Pressure

Future

- Portable hardwares will continue to evolve
- Greater resolutions (Retina Display)
- Stereoscopic 3D (Nvidia Tegra 3D)
- Multiple devices (Microsoft SmartGlass)



Meanwhile at Epic Games