

*Gama Network Presents:*

# Gamasutra.com

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## Real-Time Glow

( )

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*Gamasutra*

*May 26, 2004*

URL: [http://www.gamasutra.com/features/20040526/james\\_01.shtml](http://www.gamasutra.com/features/20040526/james_01.shtml)

(Nakamae et al. 1990).

가

가

(Spencer 1995).

LDR I

2003),

2

(Kawase

Productions)

가

(Monolith

2.0

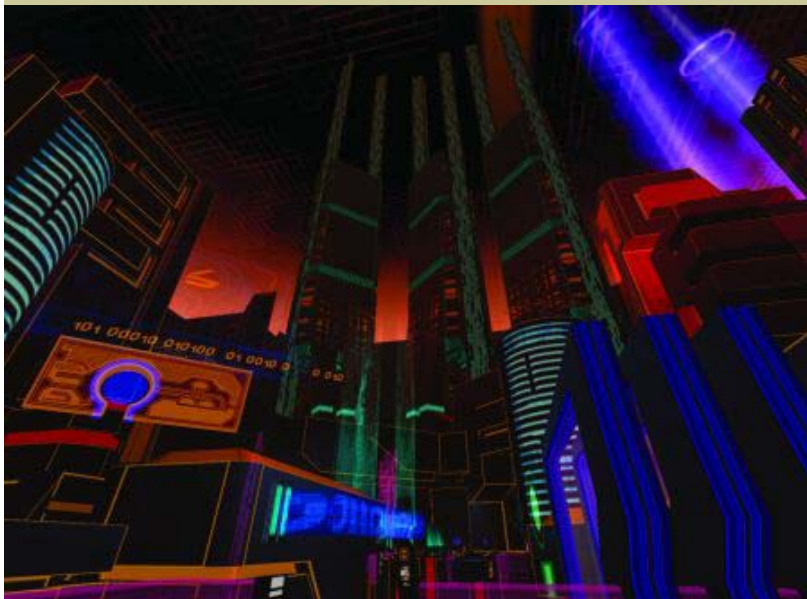
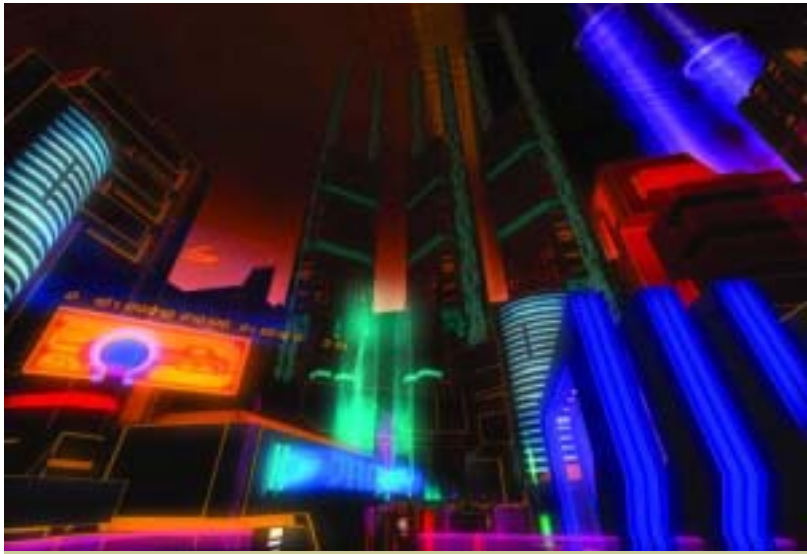
60

1

2

2.0





1. 2.0

,

/



2. 2.0

가

가 가 .

“ 가 ”

가

가

2.0

2D

가

가

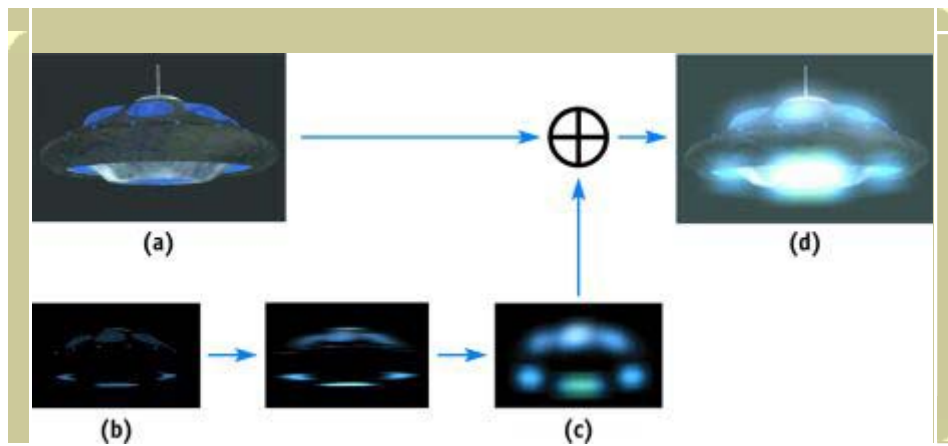
3

가

3b

2

가





가 ( ) ,  
 .  
 RGB .  
 .  
 0 ,  
 ,  
 UFO . 4 ,  
 ,  
 (RGB x ) ,  
 .

- -  
 Direct3D 9

D3DUSAGE\_RENDERTARGET .  
 가 : (1)

, (2) IDirect3DDevice9::StretchRect(...)  
 - .

3D  
 StretchRect(...) 2D 가  
 StretchRect(...) - .  
 .

StretchRect(...) ,  
 - .  
 StretchRect(...)  
 RGB .  
 .  
 ,





가

, 2

$d^2$

50x50  
2500

!

(Separable convolution)

2

$d^2$  2d  
100 , 50x50

,  $n \times m$

2

$n$   $m$

$n \times m$

$n + m$

2

$n$

$m$

$n$   $m$

가

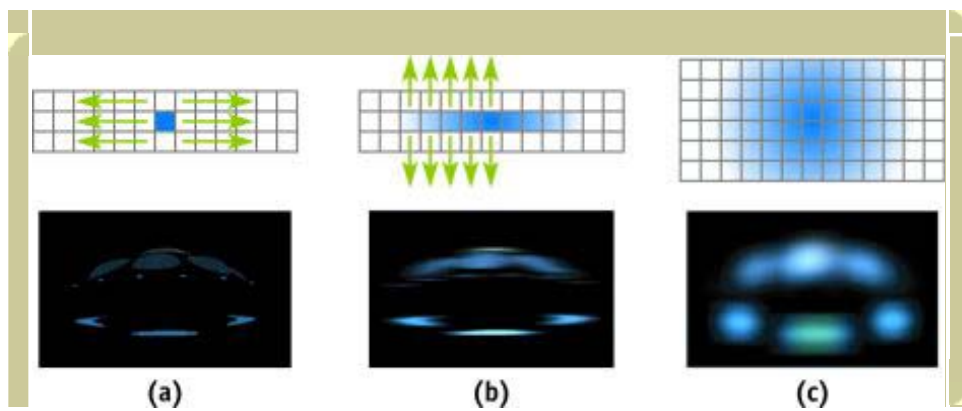
2

2D

가

가

2D  
[OpenGL.org](http://OpenGL.org)  
 가  
 가  
 2D 가 , 1D 가 1D  
 가 2D 가  
 가 Direct3D “ ” (NVIDIA  
 2002)  
 가 CD



5. 2  
(a)  
(b)  
(c)

GPU

GPU  
가 GPU 가  
가

가

가 0.0 1.0 가

6

GPU

GPU

James 2001

[developer.nvidia.com](http://developer.nvidia.com)

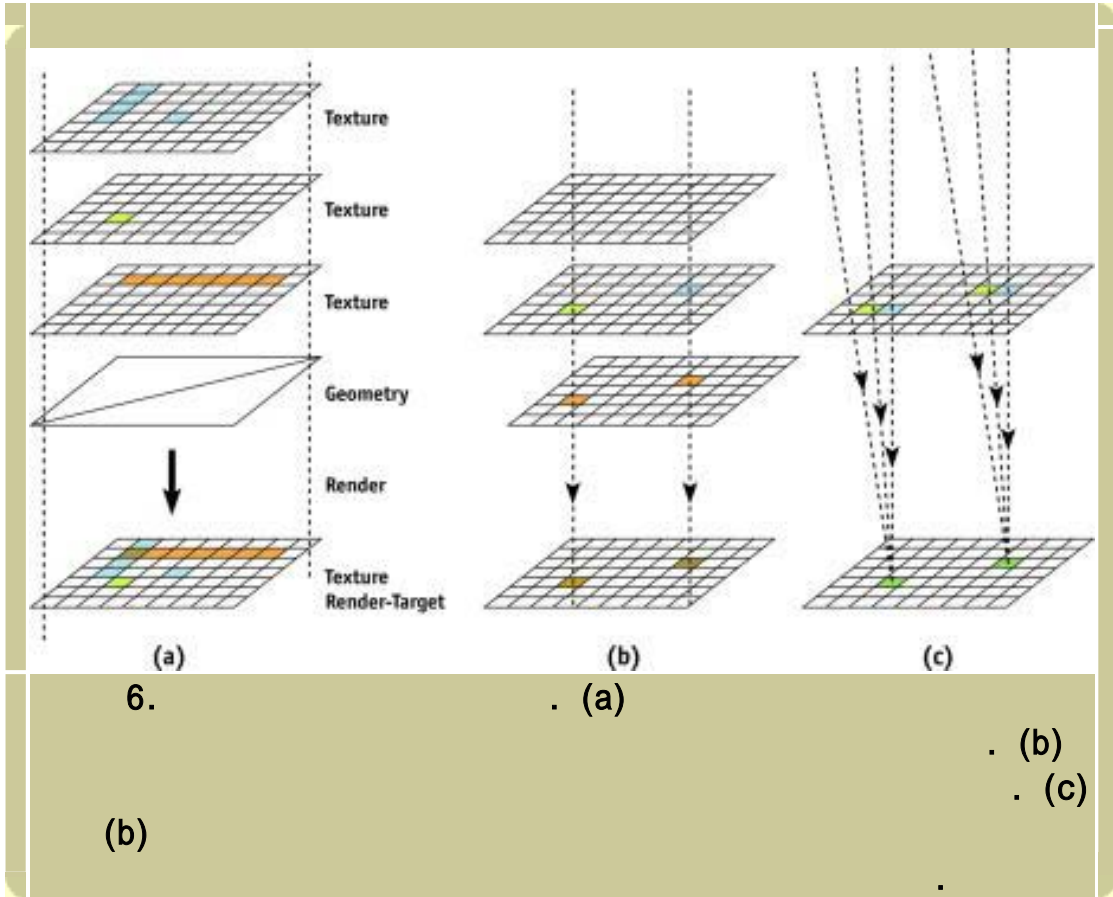
[gpgpu.org](http://gpgpu.org)

1D 가  
 1D ( ) 가  
 , 가

Direct3D 9. Direct3D 9 ps.2.0

vs.2.0 ps.2.0  
 1 2 vs.2.0 ps.2.0  
 ( )  
 $(x, y) = ([-1, 1], [-1, 1])$

가



```
dcl_position v0
dcl_normal v1
dcl_color v2
dcl_texcoord v3

mov oPos, v0 // output the vertex position in screen
space

// Create neighbor-sampling texture coordinates by
// offsetting a single input texture coordinate according
// to several constants.

add oT0, v3, c0
add oT1, v3, c1
add oT2, v3, c2
add oT3, v3, c3
add oT4, v3, c4
add oT5, v3, c5
add oT6, v3, c6
add oT7, v3, c7
```

## 1. Direct3D

```

// Take 8 neighbor samples, apply 8 conv. kernel weights
to
// them
dcl t0.xyzw // declare texture coords
dcl t1.xyzw
dcl t2.xyzw
dcl t3.xyzw
dcl t4.xyzw
dcl t5.xyzw
dcl t6.xyzw
dcl t7.xyzw
dcl_2d s0 // declare texture sampler
// Constants c0..c7 are the convolution kernel weights
// corresponding to each neighbor sample.
texld r0, t0, s0
texld r1, t1, s0
mul   r0, r0, c0
mad   r0, r1, c1, r0
texld r1, t2, s0
texld r2, t3, s0
mad   r0, r1, c2, r0
mad   r0, r2, c3, r0
texld r1, t4, s0
texld r2, t5, s0
mad   r0, r1, c4, r0
mad   r0, r2, c5, r0
texld r1, t6, s0
texld r2, t7, s0
mad   r0, r1, c6, r0
mad   r0, r2, c7, r0
mov  oC0, r0

```

## 2. Direct3D

가 가

가

. Direct3D

OpenGL

. Direct3D

OpenGL

. CPU . c0 c7  
 Direct3D 8. Direct3D 8  
 , 4 .  
 , .  
 ( 256 × 256 512 × 512 ).  
 3 4 vs.1.1 ps.1.3 .

```

vs.1.1
dcl_position v0
dcl_texcoord v3
mov oPos, v0 // output the vertex position in screen
space
// Create neighbor-sampling texture coordinates by
// offsetting a single input texture coordinate according
// to several constants.
add oT0, v3, c0
add oT1, v3, c1
add oT2, v3, c2
add oT3, v3, c3
  
```

3.

Direct3D



```

tex t0 // sample 4 local neighbors
tex t1
tex t2
tex t3
// multiply each by kernel weight and output the sum
mul r0, t0, c0
mad r0, t1, c1, r0
mad r0, t2, c2, r0
mad r0, t3, c3, r0

```

#### 4. 가 가 Direct3D

Direct3D 7. Direct3D 7

가 ,

가 가 .

(quad)  
가 ,

가

SetTextureStageState(..) API

DrawPrimitive(..) 가

- HDRI

가

, 가  
(percentage-closer filtering)

(irradiance map)  
Hanrahan 2001).

(Ramamoorthi and  
(nonphotorealistic)

가  
(Lens flare),

가

*2.0*

가

가

가

*2.0*

가

:

가

*2.0*

가

2.0

가 가

21-7

가

가

가

가

2.0

256x256

가

가

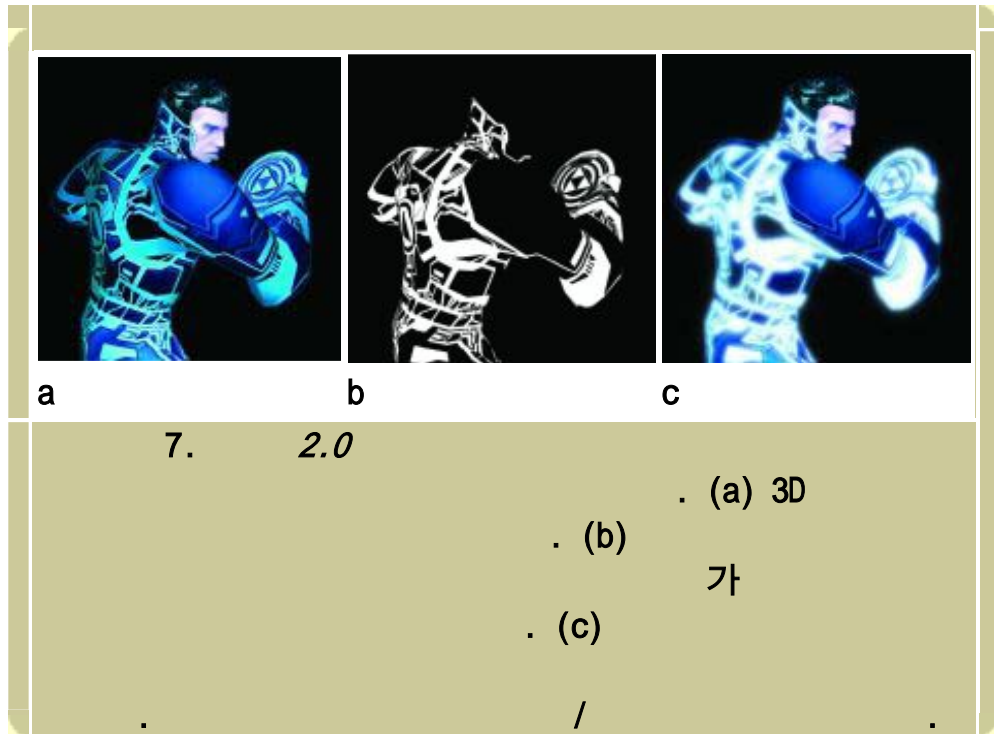
가 (fog)

가

가

가

8



DirectX 7

가

DirectX 7

[0, 1]

0

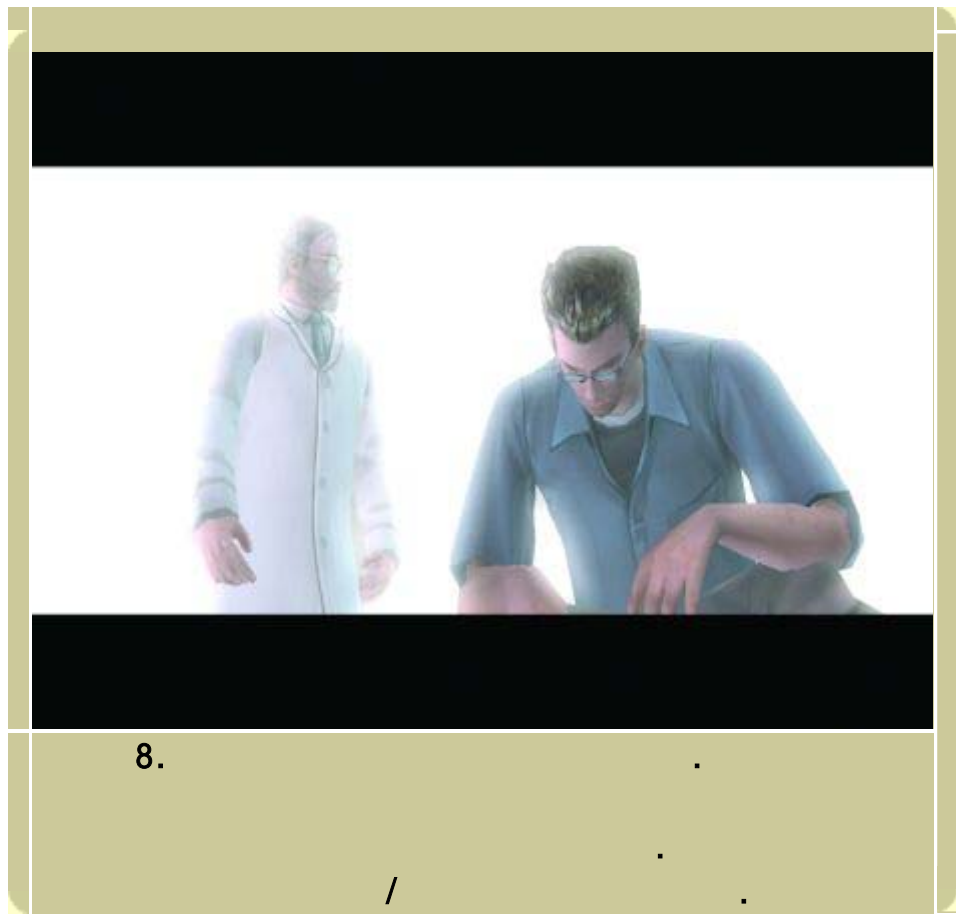
255

가

DirectX 7

8

가 가 . 가  
 , 가 가  
 가  
 0.13 가 33.15 가 .  
 33 . 가 33 , 0.15  
 가 . DirectX7  
 가 .  
 8



가  
 2.0



가 가 .  
가

가

2.0

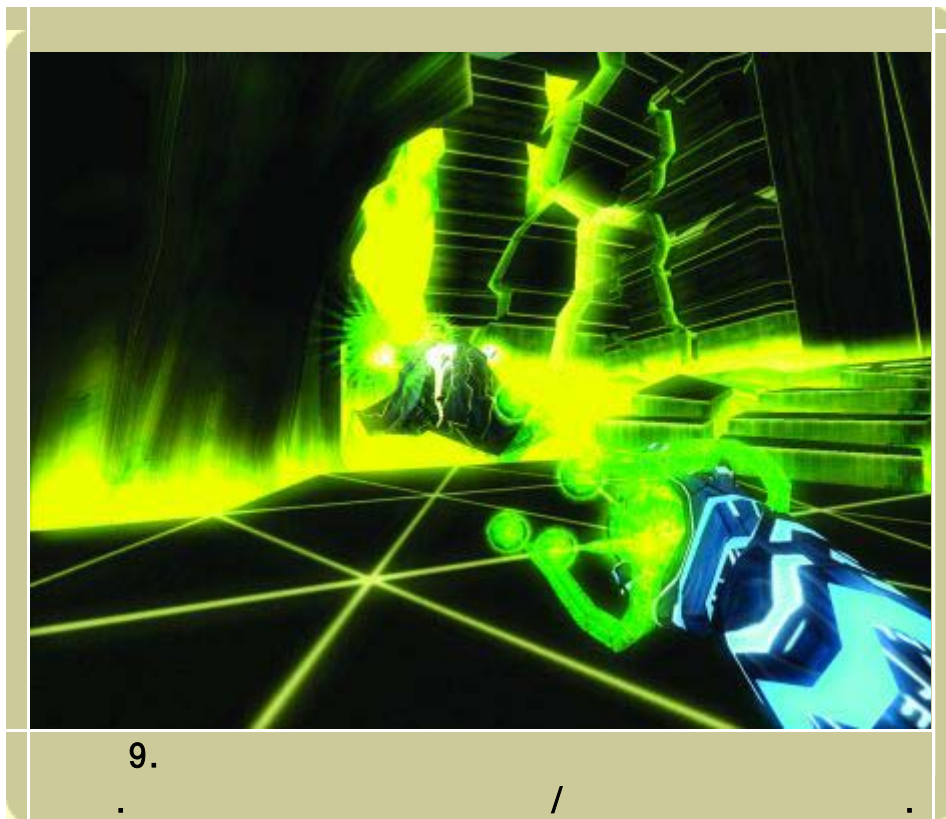
가

가

9가

가

가



[developer.nvidia.com](http://developer.nvidia.com)

. NVIDIA

가

가

C++

가

가

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NVIDIA

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