Creating Real Shaders in FX Composer

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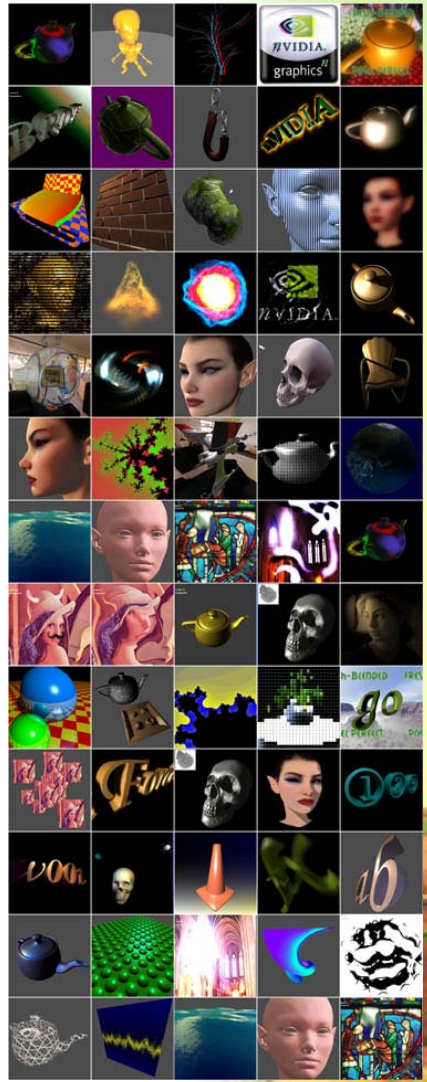
HLSL for both Artists and Programmers

- High-Level talk here at GDC
- Examples of what you can do in FX Composer
  - Code details in these slides, available at http://developer.nvidia.com along with complete source code
- Your Models, Your Game Engine...
- Using FX Composer with DCC tools
  - Alias Maya
  - 3DS Max 7
  - RTZen Ginza

Touring the SDK Effects Examples

- **What's in there: more than we can show in the next few minutes!**
- **Start projects from the NVIDIA SDK Browser, or look in these directories:**
  - **MEDIA\project:** FX Composer project files
  - **MEDIA\HLSL:** individual .fx files
  - **MEDIA\scripts:** VB & C# script samples
- **Names identify general classes of .fx files: regular materials, "scene_xxx," "post_xxx," "pre_xxx," and "paint_xxx"**
- **Projects show shaders set-up, and sometimes show shaders interacting**



Some SDK Projects

Programmers: HLSL Beyond the Manual

- **This talk will include examples that show how to:**
  - **Use the CPU to generate textures etc**
  - **Use DirectX/XNA's DXSAS scripting**
  - **Write shaders for both DCC apps and FX Composer**
  - **Call on macros and functions from the NVIDIA #include files (.fxh) with FX Composer:**
    - `Quad.fxh, shadowMaps.fxh, Noise_3d.fxh, noise_2d.fxh, Spot_tex.fxh, nvMatrix.fxh`
- **Get at new NV4x Features**

DXSAS Scripting

- **These examples include techniques for:**
  - **MRTs**
  - **Loops of Passes**
  - **Looping on Booleans**
  - **FXCOMPOSER_RESET**
  - **Re-Using Texture Samplers**
  - **Using the GPU for Texture Creation**

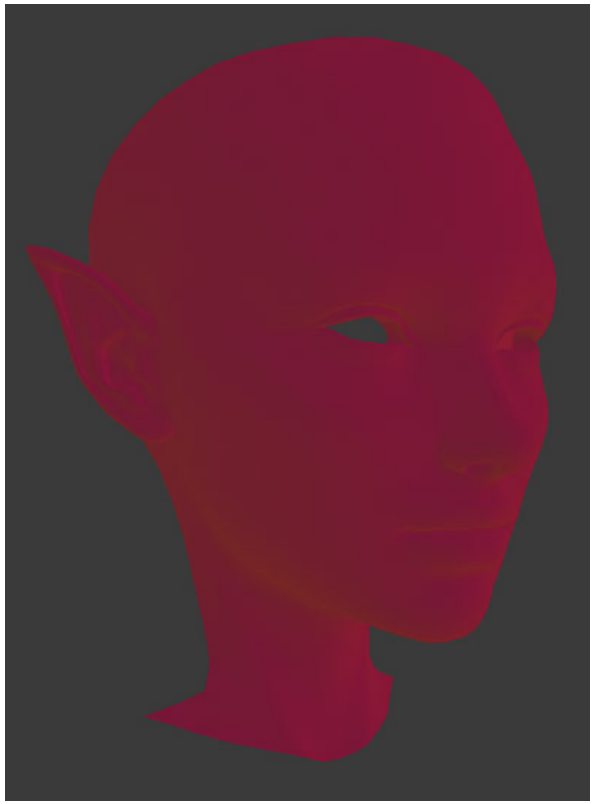
Example Shader: scene_lineDraw.fx

- Uses #include
- Uses MRT
- Uses “half” data
- Uses DXSAS scene commands
- Uses static data

Sample from scene_lineDraw.fx

Edge Detect Based on Normals

- **Potential, but Has Artifacts**

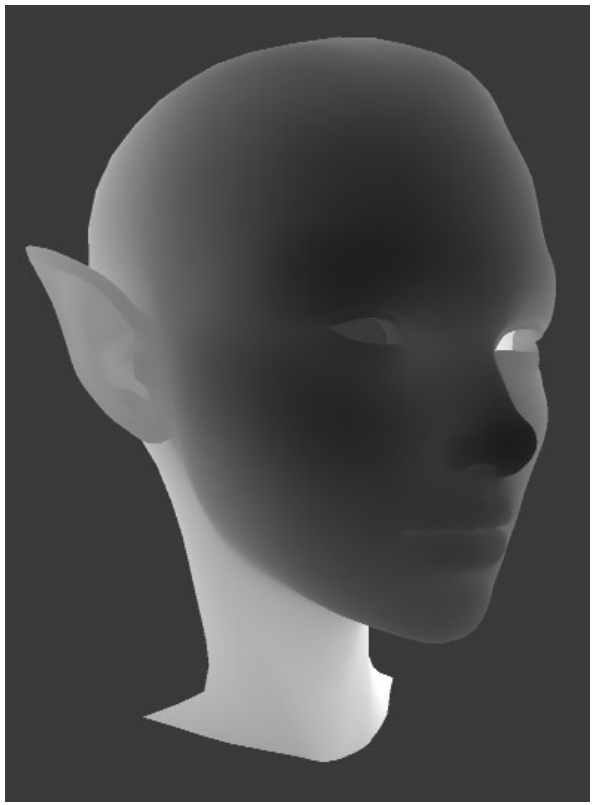


Worldspace Normals

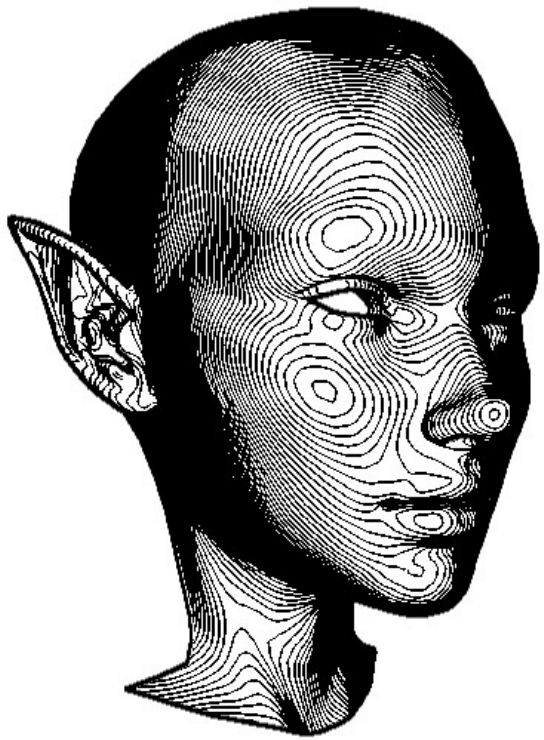
Edges

Edge Detect Based on Depth

- **Has Different Artifacts**



Depth



Edges

Combining Results

- **Much Smoother, Artifacts tend to cancel even in bad cases**

Artist-tweaked

Intersection of (Poor) Edges

Parameters We Will Need

- **The parameters we borrow from the original shaders:**
  - **Two edge-detect threshholds**
  - **Hither/Far values for depth image**
- **For scene commands:**
  - **Color for screen-clear**
  - **Value for depth-clear (hidden)**

lineDraw - beginning

- We include “Quad.fxh” for macros, types, and shader functions
- QUAD_REAL defaults to “half”
  - We can override it by #defining QUAD_FLOAT before #including Quad.fxh
- We will use Quad.fxh Render-to-Texture Declaration Macros
- Quad.fxh also provides vertex and pixel shader functions for simplest screen-aligned-quad cases: writing “straight” textures.

```
#include "Quad.fxh"
```

lineDraw – starting DXSAS

- **This shader is a “scene” effect**
- **We provide mutliple techniques, for different HW profiles**
- **Two extra techniques for artist tuning**

```
float Script : STANDARDSGLOBAL <
    string UIWidget = "none";
    string ScriptClass = "scene";
    string ScriptOrder = "standard";
    string ScriptOutput = "color";
    string Script =
    "Technique=Technique?NV3X:NV4X:NormsOnly:DepthOnly;";
> = 0.8; // version #
```

ScriptClass

Dedicated “Artist” Techniques

lineDraw “untweakables”

- **Tracked automatically by app - no user override**
- **UIWidget = “none” improves performance**

No Widget Display

```
float4x4 WorldITXf : WorldInverseTranspose <
                              string UIWidget="None"; >;
float4x4 WorldViewProjectionXf : WorldViewProjection <
                              string UIWidget="None"; >;
float4x4 WorldViewXf : WorldView <
                              string UIWidget="None"; >;
float4x4 WorldXf : World <
                              string UIWidget="None"; >;
float4x4 ViewIXf : ViewInverse <
                              string UIWidget="None"; >;
```

lineDraw static parameters

- Static values are “invisible” to the UI
- Calculated by the CPU
- Can call most HLSL functions, intrinsic or user-defined
- QUAD_REAL type declared by Quad.fxh
- QuadTexOffset and QuadScreenSize are hidden parameters declared by Quad.fxh

static

```
static float EdgeT2 = (Threshhold * Threshhold);
static float DeepT2 = (ThreshholdD * ThreshholdD);

static QUAD_REAL2 TexelCornerOffset =
       QUAD_REAL2(QuadTexOffset/(QuadScreenSize.x),
                  QuadTexOffset/(QuadScreenSize.y));
```

lineDraw Texture Declarations

- **Macros from “Quad.fxh” for common RTT texturing**
- **Standard declarations (like these) match screen size exactly (so resizing the window will re-allocate them)**

```
DECLARE_QUAD_TEX(NormTexture,NormSampler,"X8R8G8B8")
DECLARE_QUAD_TEX(DeepTexture,DeepSampler,"X8R8G8B8")
DECLARE_QUAD_DEPTH_BUFFER(DepthBuffer, "D24S8")
```

lineDraw Template

- **QUAD_REAL data**
- **We perform both edge detects and multiply the results**
- **:COLOR semantic on function itself**

Function Output Semantic

```
QUAD_REAL4 edgeDetect2PS(EdgeVertexOutput IN) : COLOR {
   QUAD_REAL n = edgeDetectGray(IN,NormSampler,EdgeT2);
   QUAD_REAL d = edgeDetectR(IN,DeepSampler,DeepT2);
   QUAD_REAL line = 1 - (n*d);
   return line.xxxx;
}
```

Complete Technique

- **Looks Complex but Just 4 (or 3) Chunks:**
  - **Script; Normal, Depth, & Edge Passes**

```
technique NV3X <
          string Script = "Pass=Norms;"
                          "Pass=Depth;"
                          "Pass=ImageProc;";
> {
          pass Norms <
               string Script = "RenderColorTarget0=NormTexture;"
                          "RenderDepthStencilTarget=DepthBuffer;"
                          "ClearSetColor=BlackColor;"
                          "ClearSetDepth=ClearDepth;"
                          "Clear=Color;"
                          "Clear=Depth;"
                          "Draw=Geometry;";
          > {
                          VertexShader = compile vs_2_0 simpleVS();
                          ZEnable = true;
                          ZWriteEnable = true;
                          CullMode = None;
                          AlphaBlendEnable = false;
                          PixelShader = compile ps_2_a normPS();
          }
          pass Depth <
               string Script = "RenderColorTarget0=DeepTexture;"
                          "RenderDepthStencilTarget=DepthBuffer;"
                          "ClearSetColor=BlackColor;"
                          "ClearSetDepth=ClearDepth;"
                          "Clear=Color;"
                          "Clear=Depth;"
                          "Draw=Geometry;";
          > {
                          VertexShader = compile vs_2_0 simpleVS();
                          ZEnable = true;
                          ZWriteEnable = true;
                          CullMode = None;
                          AlphaBlendEnable = false;
                          PixelShader = compile ps_2_a deepPS();
          }
          pass ImageProc <
              string Script = "RenderColorTarget0=;"       // re-use
                          "RenderDepthStencilTarget=;"
                          "Draw=Buffer;";
          > {
                          cullmode = none;
                          ZEnable = false;
                          ZWriteEnable = false;
                          AlphaBlendEnable = false;
                          VertexShader = compile vs_1_1 edgeVS();
                          PixelShader = compile ps_2_0 edgeDetect2PS();
          }
}
```

Technique: Chunk 1 of 4

- DXSAS scripts at each step
- The “Technique” script is optional for this case (one pass after another)

```
technique NV3X <
   string Script = "Pass=Norms;"
                   "Pass=Depth;"
                   "Pass=ImageProc;";
>  {
   // . . .
```

Technique: Chunk 2 of 4

- **We redirect color output to “NormTexture” & Draw the Model Geometry**

```
pass Norms <
    string Script = "RenderColorTarget0=NormTexture;"
                    "RenderDepthStencilTarget=DepthBuffer;"
                    "ClearSetColor=BlackColor;"
                    "ClearSetDepth=ClearDepth;"
                    "Clear=Color;"
                    "Clear=Depth;"
                    "Draw=Geometry;";
> {
    VertexShader = compile vs_2_0 simpleVS();
    ZEnable = true;
    ZWriteEnable = true;
    CullMode = None;
    AlphaBlendEnable = false;
    PixelShader = compile ps_2_a normPS();
}
```

Render to Texture

Offscreen Depth Buffer

All Current Models

Technique: Chunk 3 of 4

- **Redirect Color Output to "DeepTexture" & Draw Model Again**

```
pass Depth <
    string Script = "RenderColorTarget0=DeepTexture;"
                    "RenderDepthStencilTarget=DepthBuffer;"
                    "ClearSetColor=BlackColor;"
                    "ClearSetDepth=ClearDepth;"
                    "Clear=Color;"
                    "Clear=Depth;"
                    "Draw=Geometry;";
> {
    VertexShader = compile vs_2_0 simpleVS();
    ZEnable = true;
    ZWriteEnable = true;
    CullMode = None;
    AlphaBlendEnable = false;
    PixelShader = compile ps_2_a deepPS();
}
```

New Render Target

Re-use Depth Buffer

All Current Models

Technique: Chunk 4 of 4

- **Combine, Edge Detect, write result to Frame Buffer**
- *Ignore scene geometry*

```
pass ImageProc <
    string Script = "RenderColorTarget0=;"
                    "RenderDepthStencilTarget=;"
                    "Draw=Buffer;";
> {
    cullmode = none;
    ZEnable = false;
    ZWriteEnable = false;
    AlphaBlendEnable = false;
    VertexShader = compile vs_1_1 edgeVS();
    PixelShader = compile ps_2_0 edgeDetect2PS();
}
```

Reset Render Target

Reset Depth Target

Screen-Aligned Quad

lineDraw MRT Technique

- **We can collapse the first two passes**
- **Remember to reset *all* outputs!**

```
pass NormsAndDepth <
    string Script = "RenderColorTarget0=NormTexture;"
                    "RenderColorTarget1=DeepTexture;"
                    "RenderDepthStencilTarget=DepthBuffer;"
                    "ClearSetColor=BlackColor;"
                    "ClearSetDepth=ClearDepth;"
                    "Clear=Color;"
                    "Clear=Depth;"
                    "Draw=Geometry;";
> {
    VertexShader = compile vs_2_0 simpleVS();
    ZEnable = true;
    ZWriteEnable = true;
    CullMode = None;
    AlphaBlendEnable = false;
    PixelShader = compile ps_2_a geomMRT_PS();
}
```

Target 0

Target 1

Offscreen Depth Buffer

All Current Models

lineDraw MRT shader

- Use “out” to specify multiple return values
- Func can be “void” or return a value via function semantic

```
QUAD_REAL4 vecColorN(QUAD_REAL3 V) {
    QUAD_REAL3 Nc = 0.5*(normalize(V)+((1.0).xxx));
    return QUAD_REAL4(Nc,1);
}

void geomMRT_PS(
          vertexOutput IN,
          out QUAD_REAL4 normColor : COLOR0,
          out QUAD_REAL4 deepColor : COLOR1
) {
    normColor = vecColorN(IN.WorldNormal);
    QUAD_REAL d = (IN.EyePos.z-Near)/(Far-Near);
    deepColor = QUAD_REAL4(d.xxx,1);
}
```

Target 0

Target 1

MRT shader alternative form

- Shader function can be “void” or return a value via function semantic
- :COLOR0 is the same as :COLOR

Function Output Semantic

```
QUAD_REAL4 geomMRT_PS(
        vertexOutput IN,
        out QUAD_REAL4 deepColor : COLOR1) : COLOR0
{
   QUAD_REAL d = (IN.EyePos.z-Near)/(Far-Near);
   deepColor = QUAD_REAL4(d.xxx,1);
   return vecColorN(IN.WorldNormal);
}
```

lineDraw Tuning Technique 1

- **Provide a visualization for artists to tune params for edgeNorms**

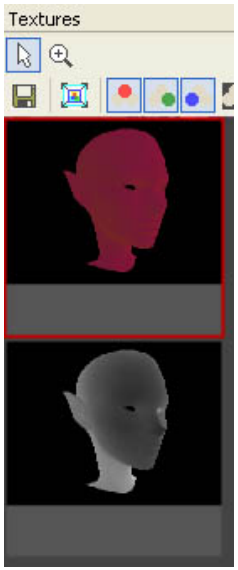
```
technique NormsOnly {
   pass Norms <
       // . . .
```

Tuned Normals Edges

lineDraw Tuning Technique 2

- **Likewise for Depth and edge parameters**

```
technique DepthOnly {
   pass Depth <
       // . . .
```

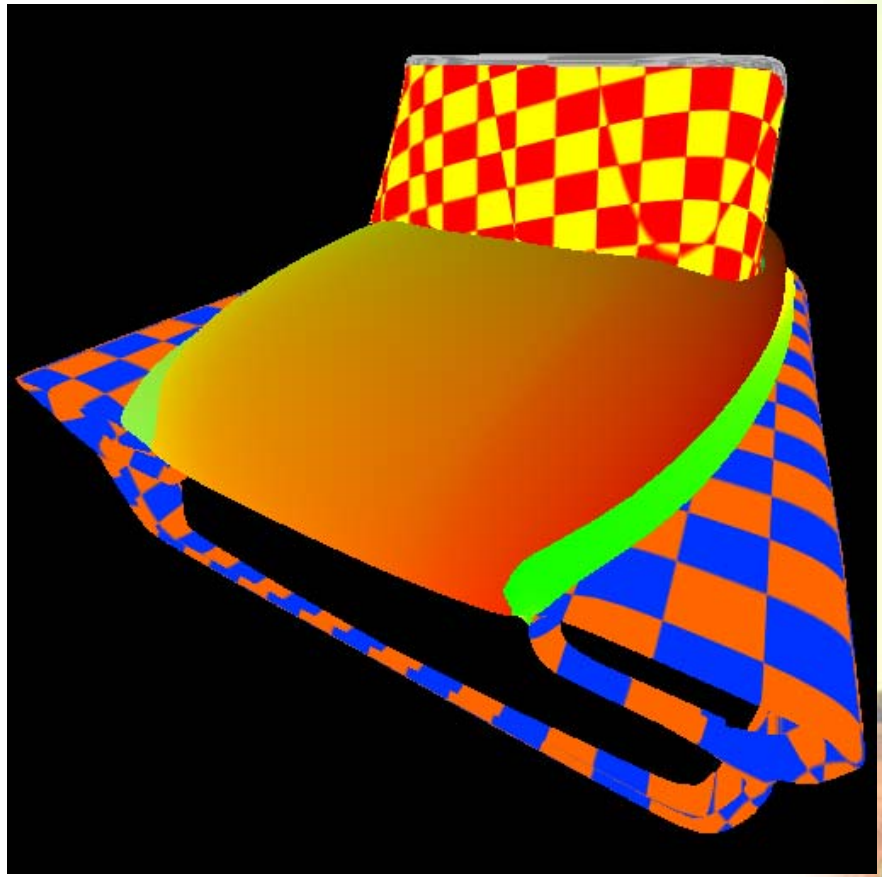


Live Texture Display in FX Composer

Tuned Depth Edges

Example Shader: SeeSpaces.fx

- Artist Visualization
- Uses texture generation and texture derivatives on CPU for fast AA
- Debugging



Sample from "DebugCab.fxproj"

Generating procedural textures

- :COLOR sematic like a pixel shader
- :PSIZE input semantic gives texel size as function is called for *each* MIP level
- This is the *only* way to get at the HLSL noise() intrinsic

```
float4 MakeStripe(float2 Pos : POSITION,float ps : PSIZE) : COLOR
{
   float v = 0;
   float nx = Pos.x+ps; // keep the last column full-on, always
   v = nx > Pos.y;
   return float4(v.xxxx);
}

#define TEX_SIZE 128
texture stripeTex <
    string function = "MakeStripe";
    string UIWidget = "None";
    float2 Dimensions = { TEX_SIZE, TEX_SIZE };
>;
sampler2D StripeSampler = sampler_state {
    Texture = <stripeTex>;
    MinFilter = LINEAR; MagFilter = LINEAR; MipFilter = LINEAR;
    AddressU = WRAP;
    AddressV = CLAMP;
};
```

Output Semantic

Input Semantic

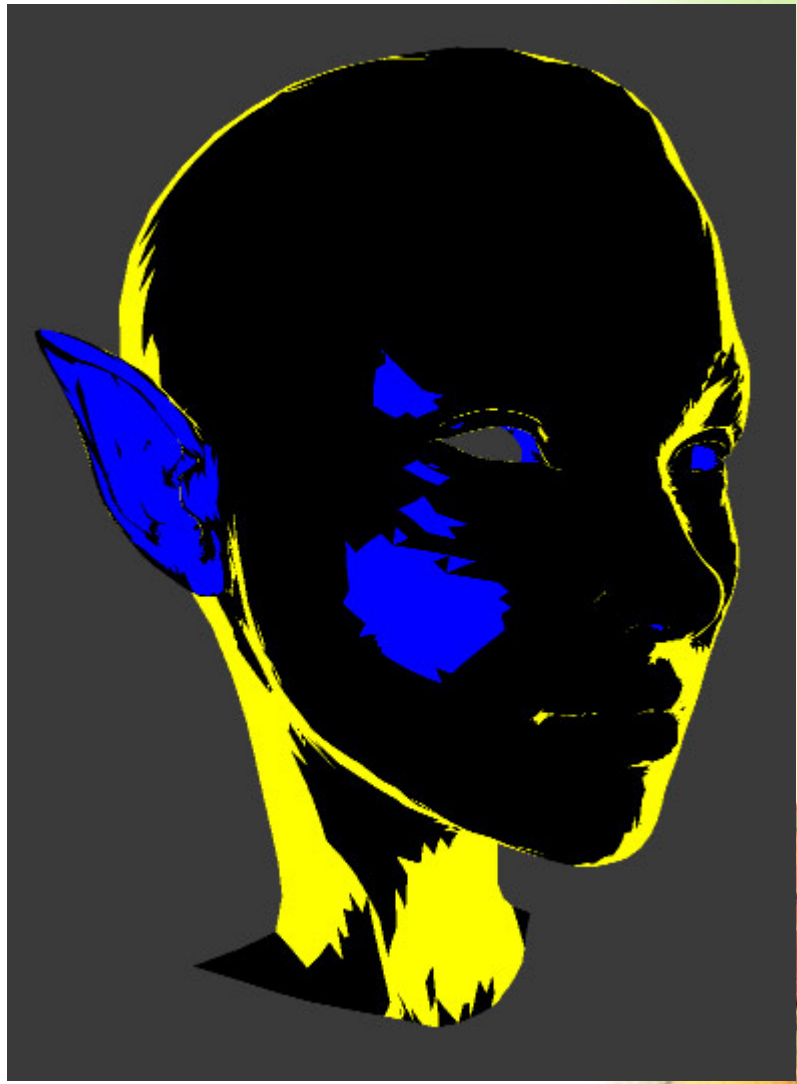
Call generator function

No user interface needed

Be sure to set address modes appropriate for individual texture and algorithm

Example Shader: uvDetective

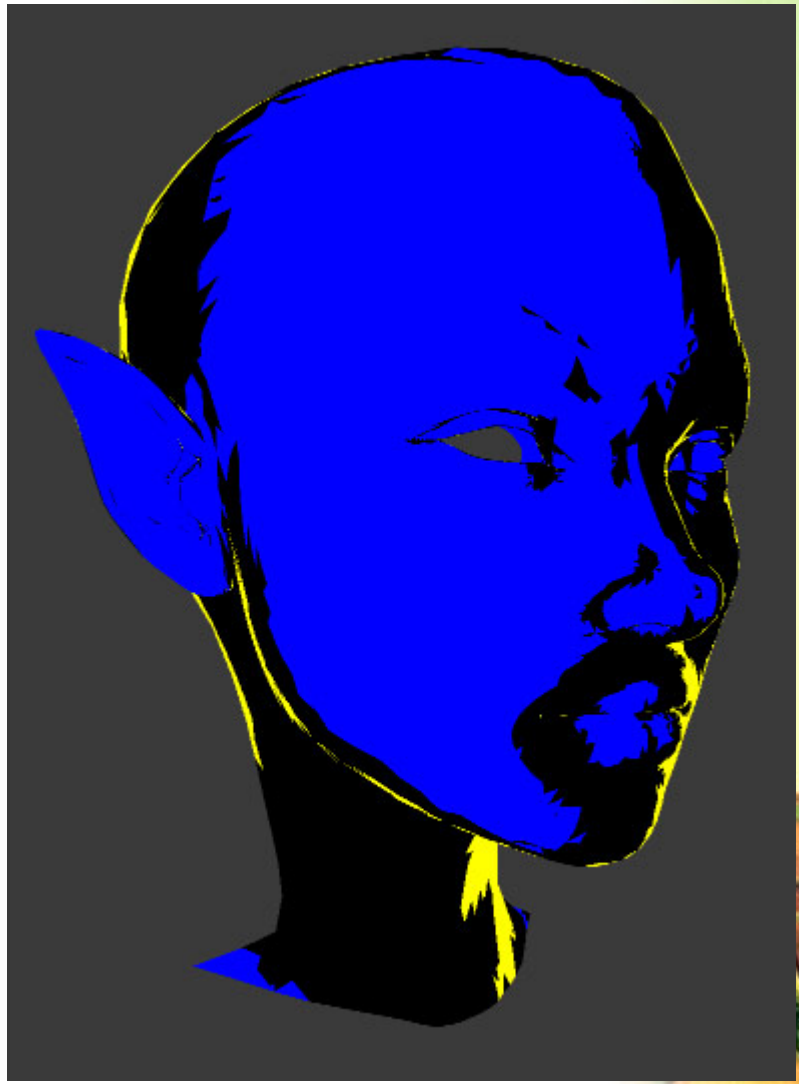
- Visualization for Artists Tuning Models
- Black – texture should be around 512x512 for close-to-texel-sized pixels



Black areas for 512x512 texture

Can be set to any size

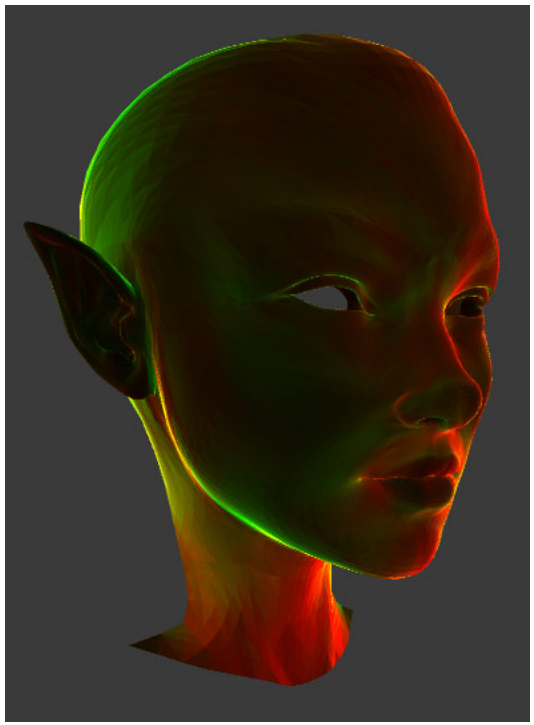
- Now black is for 256 res
- Blue shows area where a higher-res texture *could* be useful



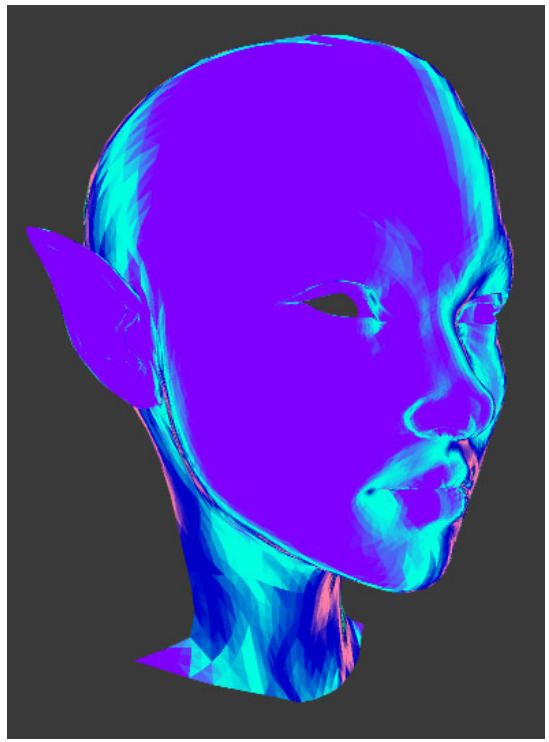
Black areas for 256x256 texture

Show Related Visualizations Too

- **Direct Derivatives and (CPU-generated) false MIP coloring**



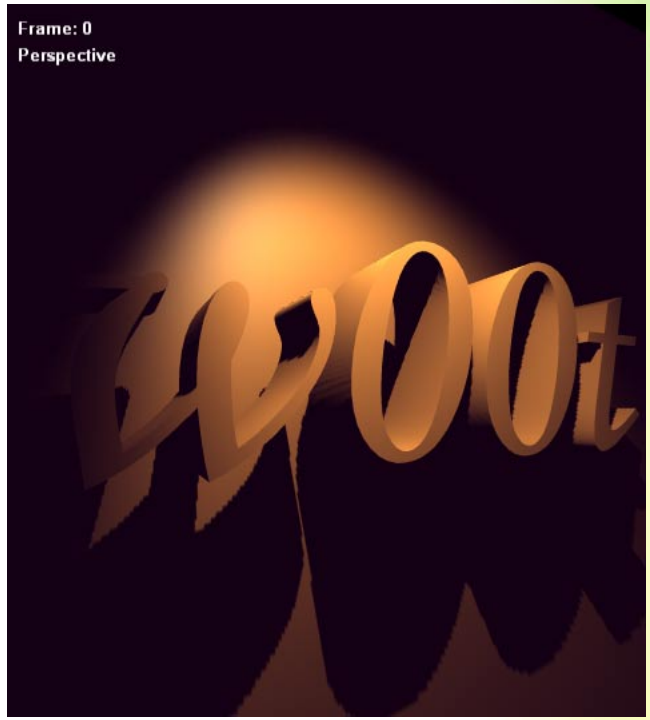
Direct Visualization of Texture Derivatives
(Amount of texture stretching)



"False Color MIP Texture" Display
(texture generated by uvDetective.fx)

Example Shader: shadowSpot2.fx

- Special shadow format
- DXSAS:
  - "sceneorobject" ScriptClass
  - Script/No Script
- Uses RenderPort
- Uses CPU intrinsics
- Include files:
  - shadowMap.fxh
  - spot_tex.fxh



HW shadow mapping

shadowSpot2 – shadow texture

- **Shadow texture format**
- **We throw away color portion**
- **Vertex shader declared for us**

Found in …\MEDIA\HLSL

```
#include “shadowMap.fxh”

DECLARE_SHADOW_XFORMS("light0",LampViewXf,
        LampProjXf,ShadowViewProjXf)
DECLARE_SHADOW_BIAS
DECLARE_SHADOW_MAPS(ColorShadMap,ColorShadSampler,
        ShadDepthTarget,ShadDepthSampler)
```

Inside shadowMap.fxh - Maps

- DECLARE_SHADOW_MAPS will set up two map and sampler pairs
- Default Size is 512
- We can override by pre-#defining SHADOW_SIZE
- Uses format "D24S8_SHADOWMAP“ which will provide HW-accelerated multisample PCF filtering

```
DECLARE_SHADOW_MAPS(ColorShadMap,ColorShadSampler,
        ShadDepthTarget,ShadDepthSampler)
```

Inside shadowMap.fxh - Transforms

- **DECLARE_SHADOW_XFORMS declares attachable transforms using special "frustum" annotation and an additional "static" declaration:**

```
// DECLARE_SHADOW_XFORMS("light0",LampViewXf,
//                LampProjXf,ShadowViewProjXf)
// expands to:

float4x4 LampViewXf : View < string frustum = "light0"; >;
float4x4 LampProjXf : Projection < string frustum = "light0"; >;
static float4x4 ShadowViewProj = mul(LampViewXf,LampProjXf);
```

"frustum" annotation

"static" declaration executes HLSL code on CPU each frame

Inside shadowMap.fxh - Bias

- DECLARE_SHADOW_BIAS will set up a user parameter “ShadBias”
- We can override range for small or large models by pre-#defining MAX_SHADOW_BIAS

```
DECLARE_SHADOW_BIAS
```

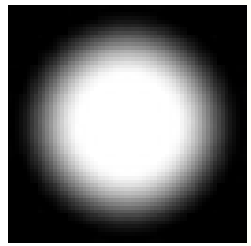
Inside shadowMap.fxh - Shaders

- Vertex shader for creating shadow maps: “shadCamVS”
- No pixel shader needed for shadow-creation passes
- Vertex shader for using shadow maps: “shadowUseVS”
  - Shadow projection TexCoords (UVs) passed in “LProj”
- Code sample in .fxh for usage in Pixel shaders

shadowSpot2 – spotlight pattern

- **“SpotSamp” sampler will be declared for you and filled**
- **Compile-time shaping options**

```
#include “spot_tex.fxh”
```



Default “spot_tex” texture

- **Call “SpotSamp” using light projection UVs like so:**

```
float cone = tex2Dproj(SpotSamp,IN.LProj);
```

shadowSpot2 – pixel shader

- **Just shadow portion**
- **“LProj” provided by vertex shader “shadowUseVS”**

```
float4 useShadowPS(ShadowingVertexOutput IN) : COLOR
{
   float3 litPart, ambiPart;
   lightingCalc(IN,litPart,ambiPart);
   float4 shadowed =  tex2Dproj(ShadDepthSampler,IN.LProj);
   return float4((shadowed.x*litPart)+ambiPart,1);
}
```

shadowSpot2 - pixel shader

- **Compare to a completely unshadowed version:**
  - **We supply an *unshadowed* version for apps with limited DXSAS scripting, like 3DStudio Max**
    - **And declare ScriptClass = "sceneorobject";**

```
float4 unshadowedPS(ShadowingVertexOutput IN) : COLOR
{
   float3 litPart, ambiPart;
   lightingCalc(IN,litPart,ambiPart);
   return float4(litPart+ambiPart,1);
}
```

shadowSpot2 - shadow technique

- **Vertex shader from .fxh file:**
- **Note assign of "RenderPort"**

```
technique Shadowed <
    string Script = "Pass=MakeShadow;"
           "Pass=UseShadow;";
> {
 pass MakeShadow <
     string Script = "RenderColorTarget0=ColorShadMap;"
          "RenderDepthStencilTarget=ShadDepthTarget;"
          "RenderPort=light0;"
          "ClearSetColor=ShadowClearColor;"
          "ClearSetDepth=ClearDepth;"
          "Clear=Color;"
          "Clear=Depth;"
          "Draw=geometry;";
 > {
    VertexShader = compile vs_2_0 shadowGenVS(WorldXf,WorldITXf,ShadowViewProjXf);
    ZEnable = true;
    ZWriteEnable = true;
    ZFunc = LessEqual;
    CullMode = None;
    // no pixel shader!
 }
 // . . . Continued . . .
```

"RenderPort" sets clipping etc correctly for this viw

Provided by shadowMap.fxh

shadowSpot2 – technique (cont'd)

- **Vertex Shader provided from .fxh**
- **Remember, Reset "RenderPort"**

```
        // . . .
        pass UseShadow <
        string Script = "RenderColorTarget0=;"
                        "RenderDepthStencilTarget=;"
                        "RenderPort=;"
                        "ClearSetColor=ClearColor;"
                        "ClearSetDepth=ClearDepth;"
                        "Clear=Color;"
                        "Clear=Depth;"
                        "Draw=geometry;";
      > {
        VertexShader = compile vs_2_0 shadowUseVS(WorldXf,WorldITXf,
                        WorldViewProjXf,ShadowViewProjXf,
                        ViewIXf,ShadBiasXf, SpotLightPos);
        ZEnable = true;
        ZWriteEnable = true;
        ZFunc = LessEqual;
        CullMode = None;
        PixelShader = compile ps_2_a useShadowPS();
        }
}
```

Reset Renderport to scene camera

Provided by shadowMap.fxh

shadowSpot2 – unshadowed technique

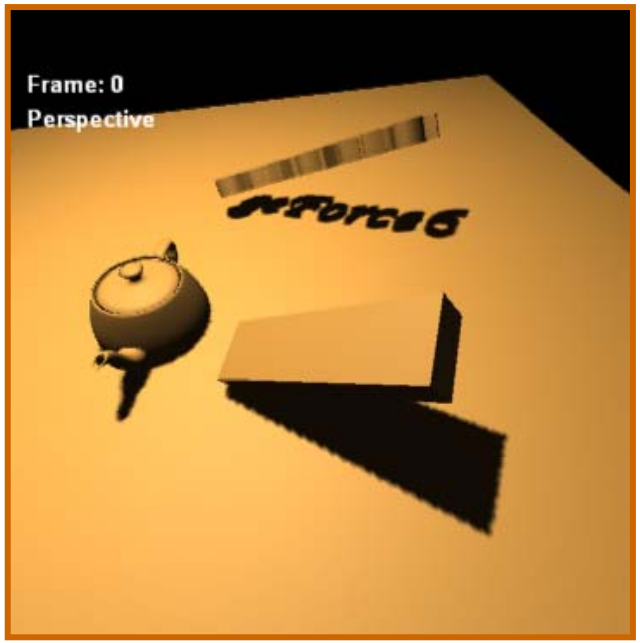
- **Provided for apps like 3DS Max**
- **Just one pass, shared code**
- **DXSAS Script optional**
- **Declare ScriptClass “sceneorobject”**

Scene w/o shadow

Provided by shadowMap.fxh

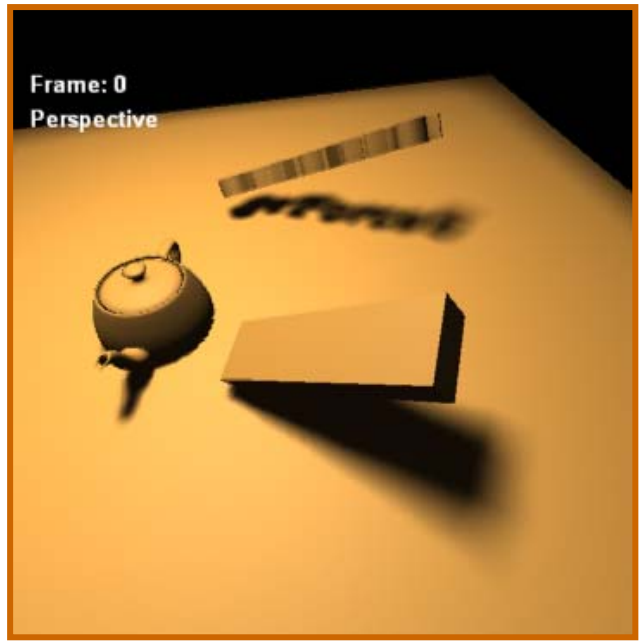
```
technique Unshadowed {
  pass NoShadow {
    VertexShader = compile vs_2_0 shadowUseVS(WorldXf, WorldITXf, WorldViewProjXf,
                                              ShadowViewProjXf, ViewIXf,
                                              ShadBiasXf, SpotLightPos);

    ZEnable = true;
    ZWriteEnable = true;
    ZFunc = LessEqual;
    CullMode = None;
    PixelShader = compile ps_2_a unshadowedPS();
  }
}
```

Differing Shadow Formats & Algorithms



D24S8 Shadow Maps

- Fast, good quality
- Antialiased on NVIDIA hardware
- Sharp edges
- Trivial to use

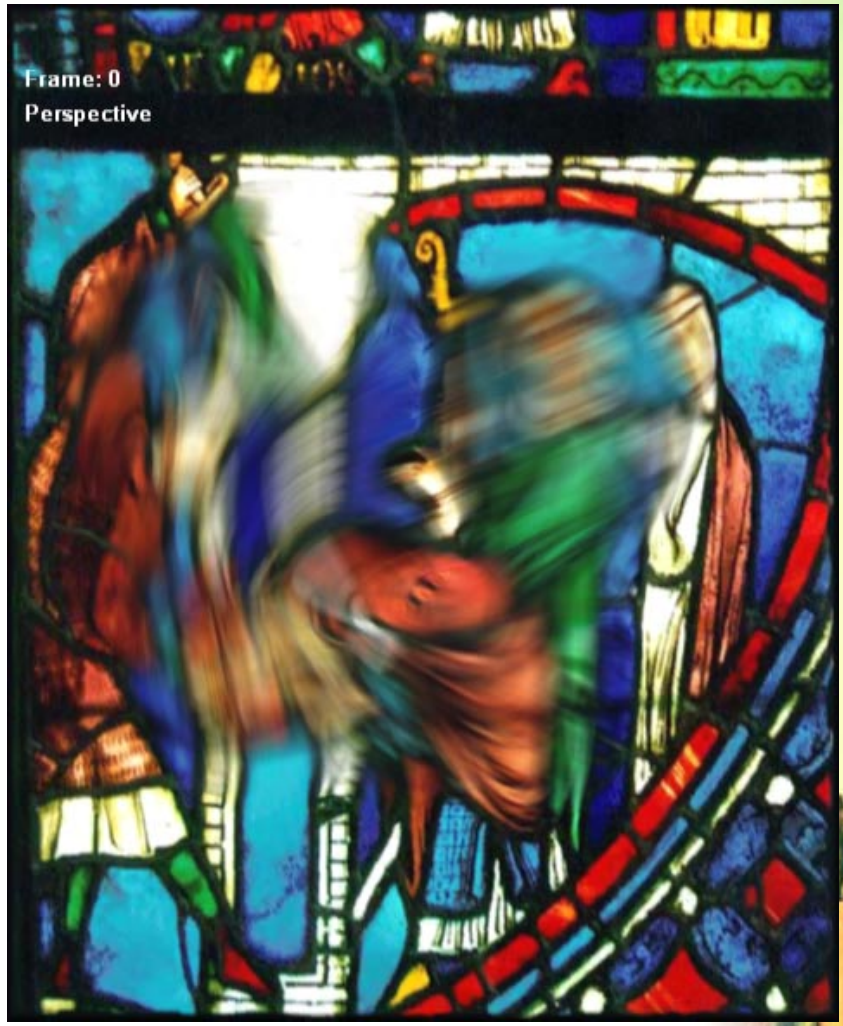


Floating Point

- Most flexible
- AA calculated in shader, so anything is possible
- Can be mixed with RGB in one texture

Example Shader: paint_blur

- Uses FP16 Blending
- Uses DXSAS accumulation loops
- Uses “bool loops”
- Uses CPU funcs and static vars for mouse tracking



Painted Accumulation-Buffer Motion Blur

Paint_blur - Three key params

- **Loop counter & limit**
- **RESET pulse boolean**
  - **Can also be toggled manually**

Hidden loop counter

```
float passnumber <string UIWidget = "none";>;
float npasses <
   float UIStep = 1.0;
   string UIName = "# of blur passes";
> = 8.0f;
bool bReset : FXCOMPOSER_RESETPULSE
<
   string UIName="Clear Canvas?";
>;
```

Dedicated Semantic

Declaring Floating Point Textures

- Just like any other texture
- Our paint strokes are added using Alpha Blending – works fine on FP16 formats
- Caution: FXC will still compile if a format is not available – it will switch to 8bit int

```
DECLARE_QUAD_TEX(PaintTex,PaintSamp,"A16B16G16R16F")
```

A sample "live" displacement texture

Paint_blur - DXSAS looping

- **Loop value from parameter in technique script**
  - **Change value to change blur quality**

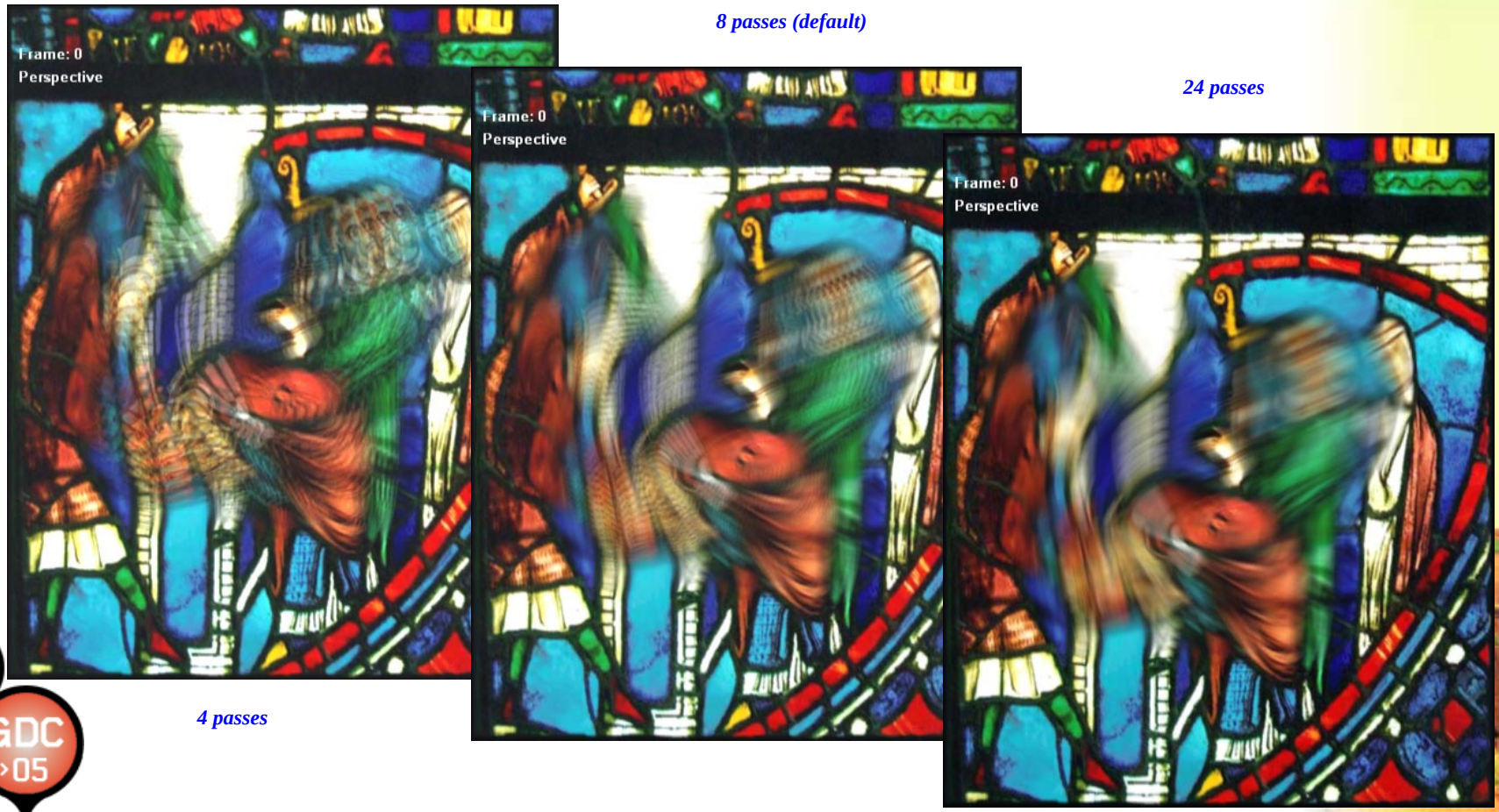
```
string Script =
   // Clear Accum Buffer
   "RenderColorTarget0=AccumBuffer;"
   "ClearSetColor=ClearColor;"
   "Clear=Color;"
   // paint into blur-dir buffer...
   "Pass=paint;"
   // accumulate
   "LoopByCount=npasses;"
       "LoopGetIndex=passnumber;"
       "Pass=Accumulate;"
   "LoopEnd;"
   // draw accum buffer to framebuffer
   "Pass=FinalPass;";
```

User-defined loop limit

Script counter assignment

Effects of Changing Pass Count

- Tune for Quality versus Performance

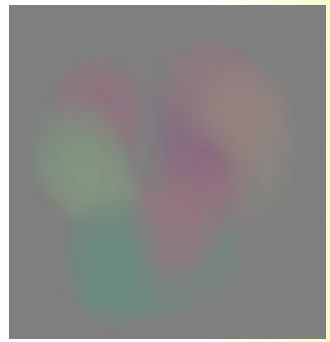


Paint_blur - DXSAS "bool" looping

- **Loop value from RESET, inside script for "Paint" pass**
  - **Painting clears itself as needed**
  - **Otherwise "PaintTex" persists from frame to frame**

```
string Script =
   "RenderColorTarget0=PaintTex;"
   "RenderDepthStencilTarget=;"
   "LoopByCount=bReset;"
              "ClearSetColor=ClearColor;"
              "Clear=Color0;"
              "LoopEnd=;"
   "Draw=Buffer;";
```

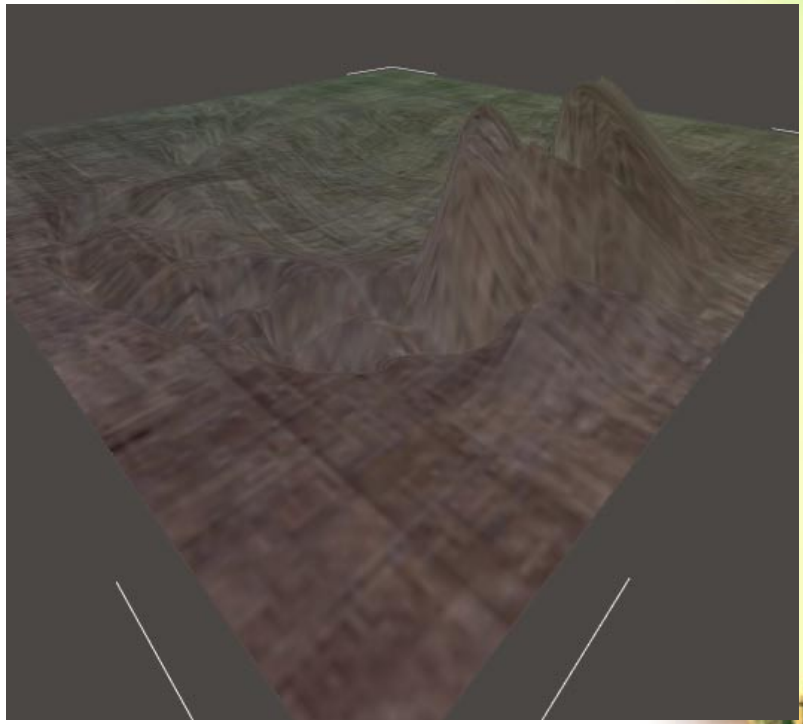
With "bool" value, acts like "if()"



"PaintTex" display

Example shader: paint_sculpt

- Uses FP blending
- Converts to FP32
- Uses FP32 VTF



Live texture sculpting on static plane

Paint_sculpt – mixing data

- **FP16 blending for paint, as before**
- **Extra copy pass for VTF FP32**
- **Use Quad.fxh utility shaders**

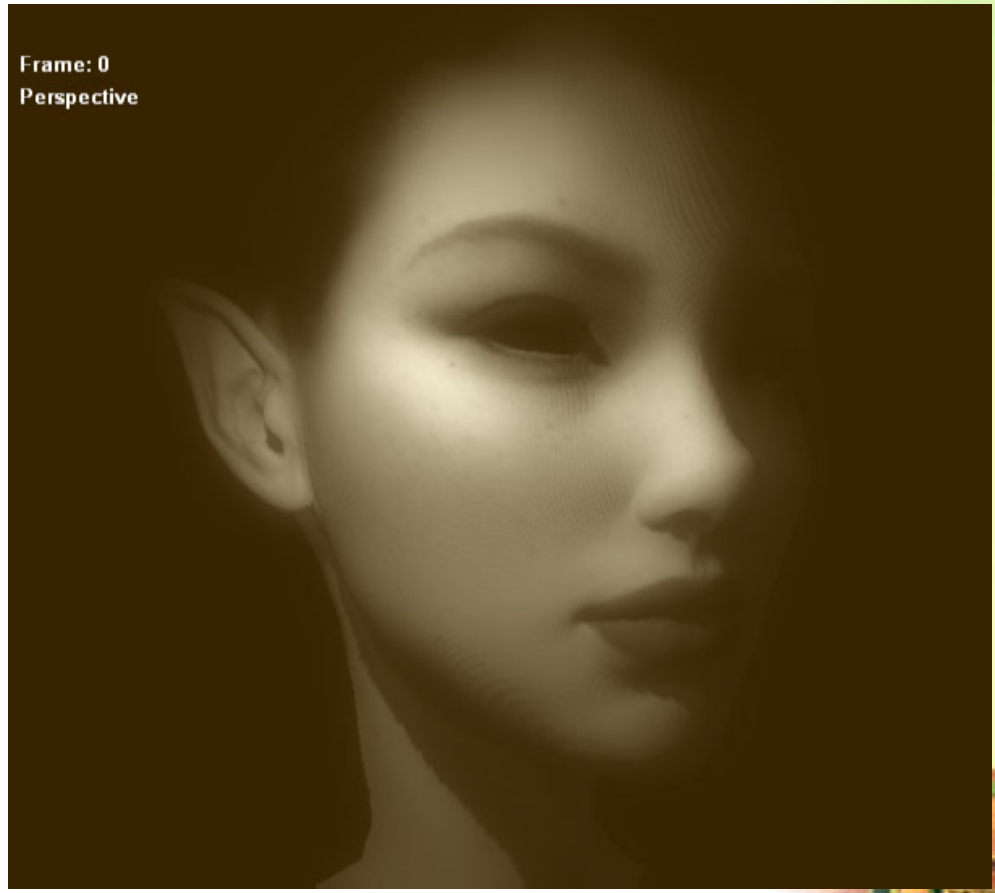
```
pass boost <
   string Script =     "RenderColorTarget0=DisplaceMap;"
                       "Draw=Buffer;";
> {
   VertexShader = compile vs_3_0 ScreenQuadVS();
   ZEnable = false;
   ZWriteEnable = false;
   CullMode = None;
   PixelShader = compile ps_3_0 TexQuadPS(PaintStrokeSampler);
}
```

Provided by Quad.fxh

Provided by Quad.fxh

Example shader(s): post_holga & friends

- Uses noise_2d, spot_tex, Quad.fxh,
- FP16 if you have it
- DXSAS Effect stacking



Dusk's 1935 Debut

Post_holga - noise textures

- **Textures are still the fastest way to get noise in pixel shading**
  - **This noise, at low scales, will also be pretty continuous at a variety of visible sizes**
- **Emulate Optical Distortion by Offseting screen U,V with 2D Noise**
- **Default NOISE2D_SCALE was 500 - we want *much* smoother noise for this application**

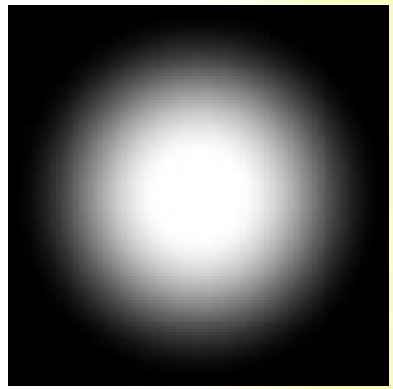
```
#define NOISE2D_SCALE 1
#define NOISE2D_FORMAT "A16B16G16R16F"
#include "noise_2d.fxh"
```

2D Noise

Post_holga - spot_tex

- Using this texture for a different purpose – to isolate distortion to the edges of the frame, and to control the vignetting effect
- Change a couple of defaults to get a different shape

```
#define SPOT_TEX_SIZE 128
#define SPOT_TEX_INSIDE 0.2
#include "spot_tex.fxh"
```



Tweaked spot_tex image

Post_holga - buffering the scene

- **Post_holga (and other postprocess effects) are declared ScriptOrder="postprocess"**
- **We use "ScriptExternal=" to hand-off scene rendering to FX Composer, while using our own texture ("SceneMap") as the scene render target, rather than the framebuffer**

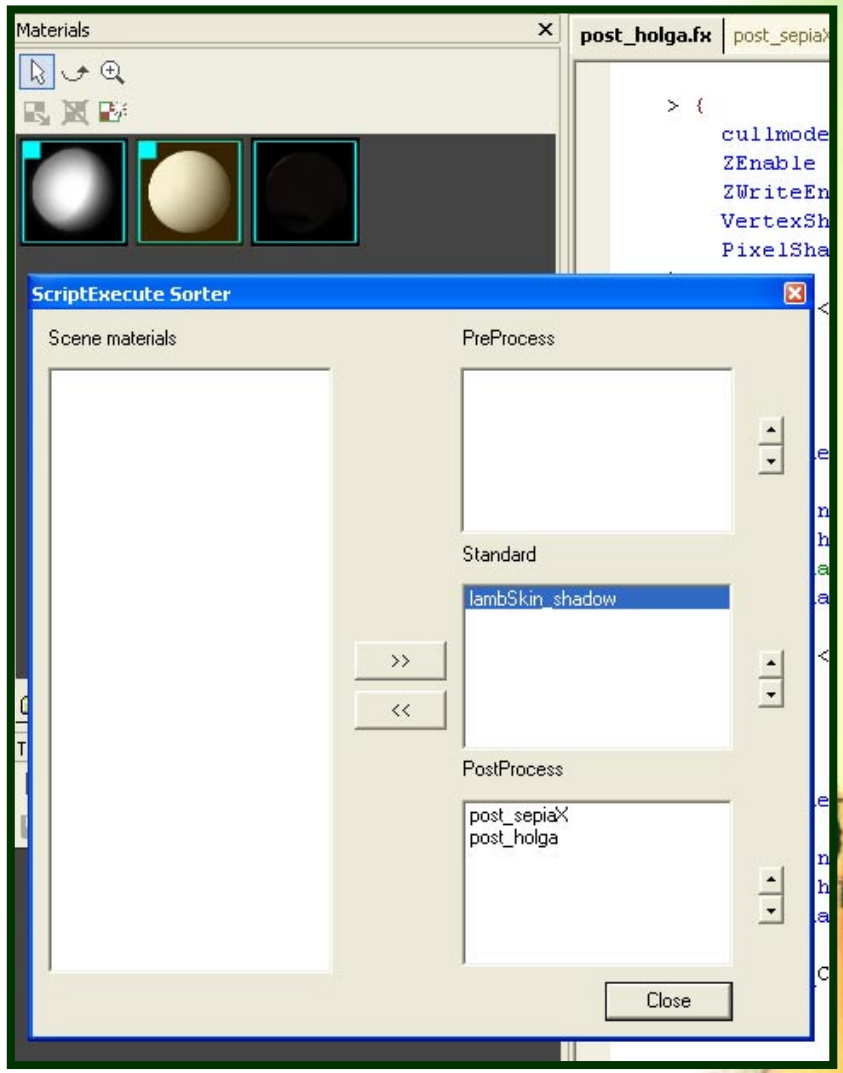
```
string Script = "ClearSetDepth=ClearDepth;"
        "RenderColorTarget=SceneMap;"
        "RenderDepthStencilTarget=DepthMap;"
        "ClearSetColor=ClearColor;"
        "ClearSetDepth=ClearDepth;"
                "Clear=Color;"
        "Clear=Depth;"
        "ScriptSignature=color;"
        "ScriptExternal=;"
        "Pass=DownSample;"
        "Pass=GlowH;"
        "Pass=GlowV;"
        // . . .
```

What do I output?

Render all "below" me

Adding More Shaders to the Scene

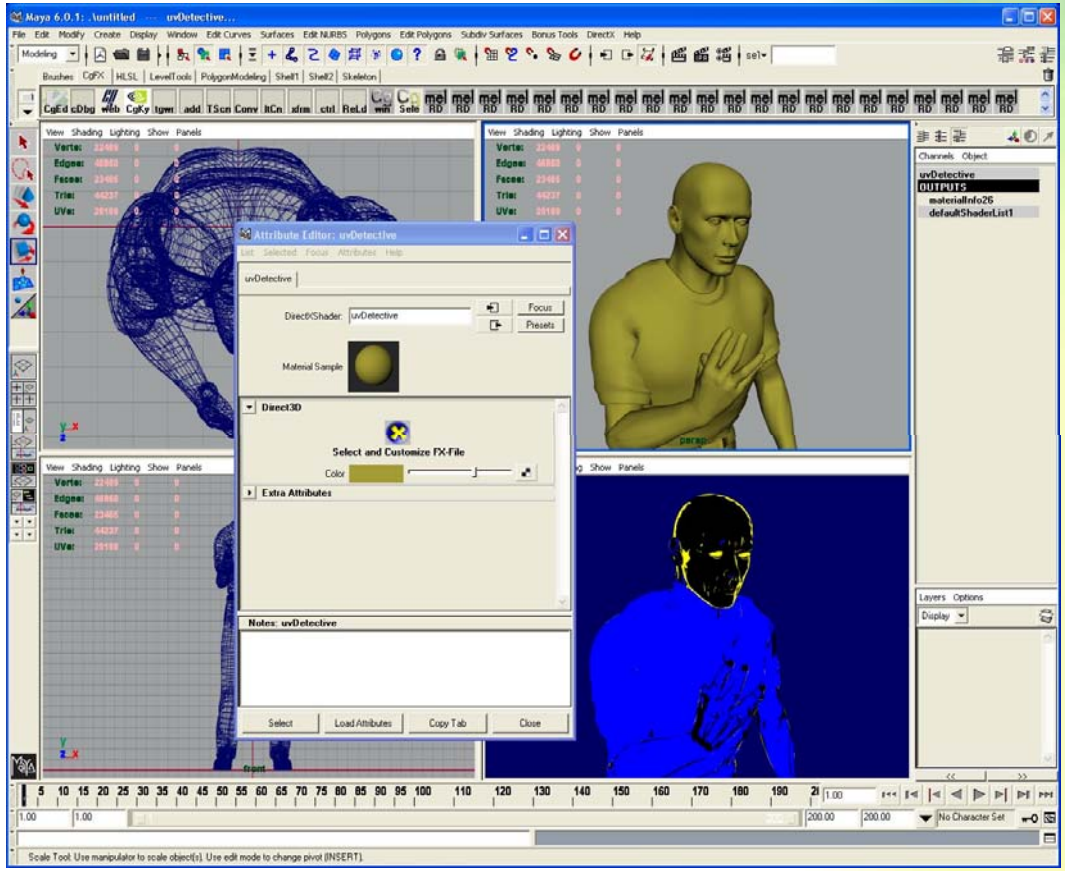
- Use the ScriptExecute Sorter, found in the menu of the Materials Pane
- Build up the look you like
- Maybe reduce to one shader later (maybe not)



The ScriptExecute Sorter

FX Composer & Maya

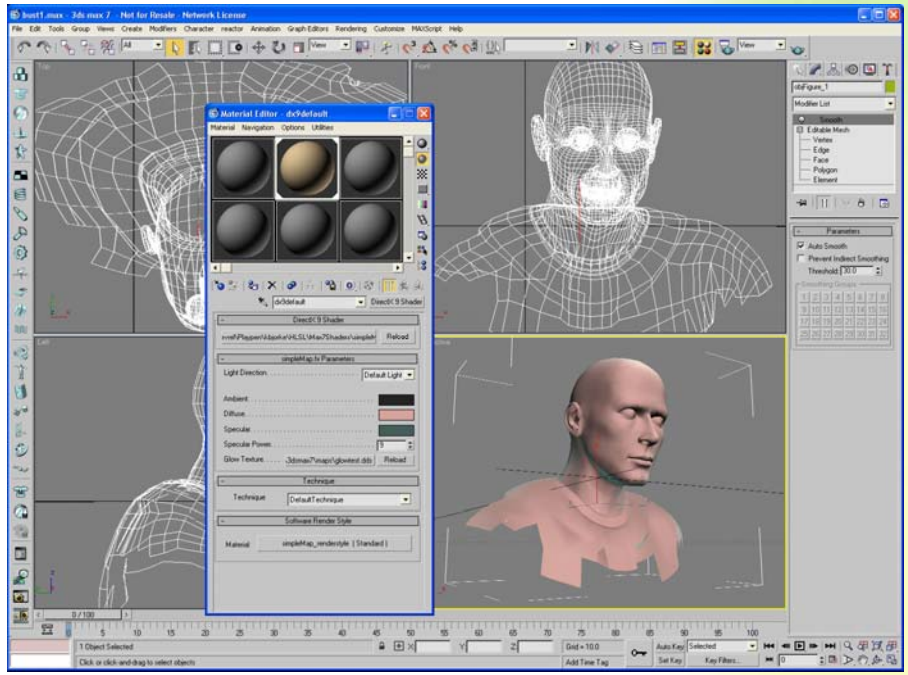
- **Microsoft DX9 Viewer**
  - **Newest in February 2005 DirectX SDK Update**
  - **Special sub-dialog from Attribute Editor**
  - **Maya 6 or Maya 5**
  - **DirectX in Maya window or “floater”**
  - **Integrates .X exporter**



Maya 6.0.1 Model showing “uvDetective”

FX Composer & 3DS Max 7

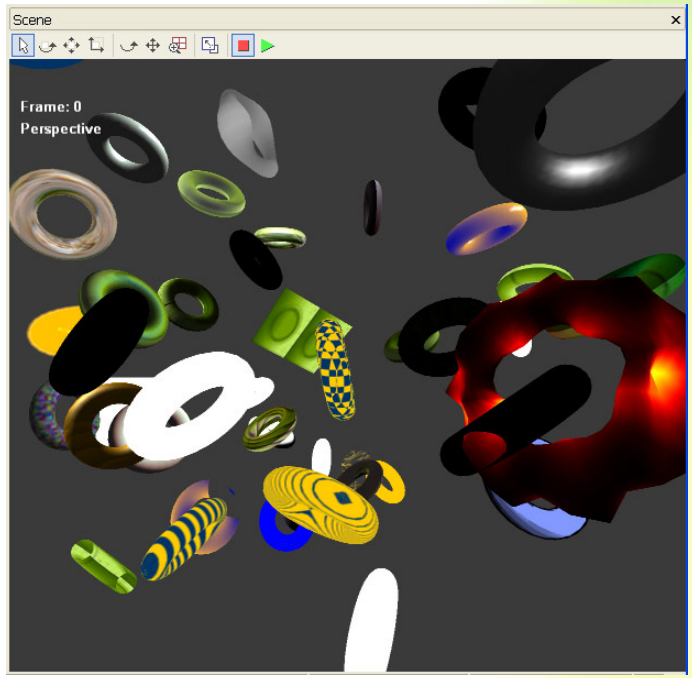
- **3DStudio Max support for DX9 built-in**
  - **Define shaders in Max Materials Pane**
  - **Limited DXSAS support so far**
  - **Which is why we make shadow scripts “smart”**
  - **New NVB exporter from 3DS Max will carry all FX Composer attributes too.**



HLSL Shader in 3DS Max 7

C# Scripting

- Can use C# or Visual Basic, with full text-edit intellisense etc
  - Works off .NET “CLR” so others could work too
- Setting Animation Keys
  - From Programs or External Files
- Creating Objects
  - From Primitives or External Files
  - Can call C++ plugins or work directly
- Cycling Through Shaders and Projects
  - Preview examples like “Scatter_scene.cs”
- Exporting
  - See example “export_material_keys.cs” to access and export all properties of the current scene to XML
- Most FX Composer Internals Are Exposed
  - Use the OLE Viewer in Visual Studio, expand library “nvsys”
    - Data types, structures, and methods are all there



Sample Animated Display from “scatter_scene.cs”

Sample C# Script: “rtzImport.cs”

- Translates app-specific semantics from RTZen Ginza (http://www.rtzen.com/) FX export files into forms most-friendly to FX Composer.
- Creates a tweaked copy of your Ginza shader, then opens it.
- Be sure to include the RTZen path “...\RTShaderGinza\media\images\” in your FX Composer Settings... dialog

Connecting Outside of FX Composer

- **User-defined annotations and semantics: "…\data\fxmapping.xml"**
- **Geometry Importers & C++ SDK**
- **More!**
  - **Details coming up from Chris Maughan…**
- *Thanks!*

Sepia + Holga + lambSkin_shadow

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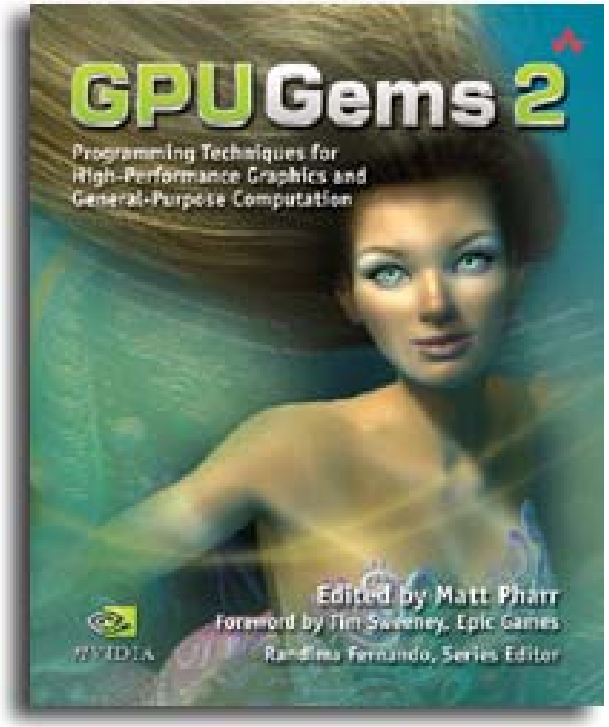

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