Marvel's Spider-Man: **Procedural Lighting Tools** GDC March 2019



© 2019 Insomniac Games, Inc.

© 2019 Marvel







Xray Halperin Senior Technical Artist



© 2019 MARVEL



SPJDER-MAN



What is Procedural in this context?

Procedural refers to algorithmic methods of creating data, as opposed to manual.









How can procedural lighting techniques augment the hard work of lighting artists by doing some of the bulk heavy lifting and free up artist time to focus on creating great content?









Procedural Lighting Workflows

1) Light Placement









Procedural Lighting Workflows

- 1) Light Placement
- 2) Light Probe Placement









Procedural Lighting Workflows

- 1) Light Placement
- 2) Light Probe Placement
- 3) Light Grid Generation

















726 tiles in the open world.

Each tile is 128x128 meters in size.



Open World Tiles







"Zones": [

"levels/l20_City/openArea/Open_World/Tile_M35/Tile_M35_art.zone", "levels/I20_City/openArea/Open_World/Tile_M35/Tile_M35_gameplay.zone", "levels/l20_City/openArea/Open_World/Tile_M35/Tile_M35_lgt.zone", "levels/I20_City/openArea/Open_World/Tile_M35/Tile_M35_ground.zone", "levels/l20_City/openArea/Open_World/Tile_M35/UnitNavData.zone", "levels/I20_City/openArea/Open_World/Tile_M35/Tile_M35_light_grid.zone", "levels/l20_City/openArea/Open_World/Tile_M35/Tile_M35_fx.zone", "levels/l20_City/openArea/Open_World/Tile_M35/Tile_M35_aud_reverb.zone", "levels/I20_City/openArea/Open_World/Tile_M35/Tile_M35_ground_overlay_act1_2.zone", "levels/l20_City/openArea/Open_World/Tile_M35/Tile_M35_ground_overlay_act3.zone", "levels/l20_City/openArea/Open_World/Tile_M35/Tile_M35_ground_overlay_act1_2_day.zone", "levels/I20_City/openArea/Open_World/Tile_M35/Tile_M35_ground_overlay_act1_2_night.zone",







Point Clouds



J30	K30	L30	M30	N30	
J31	K31	L31	M31	N31	
J32	K32	L32	M32	N32	032
J33	K33	L33	M33	N33	033
J34	K34	L34	M34	N34	034
J35	K35	L35	M35	N35	035







Point Clouds



























Prefabricated Instances

Assets are browsable through the Insomniac Vault.



ult - Orbit (6524)

t By 🕶 📢 Histo	ory 🕨 🕨	View Results	
Asset Filters	0 4	Search: Name	gz_street_light
Actor	\$7	Prefab	Prefab
	\$	I I	
Animset	\$		
Atmosphere	\$		
Cinematic2	\$		
Collection	\$		
Conduit	\$	gz_street_light_on	gz_street_light_on
	습		_bridges
Level	4		
Light	습		
Localization	\$		
Material	☆		
Materialgraph	☆		
Model	4		
Modelvariant	4		
Movie	4		
Performanceclip	4		
Performanceset	4		
🗹 Prefab	4		
Region	슈		
Scriptgraph	\$		
Soundbank	4		
Texture			
Visualeffect	1		
Volume			
Zone	合		





Prefabricated Instances

Assets are browsable through the Insomniac Vault.



















































































```
"AssetType": "kEnvProbe",
   "Id": "0x8f1010910470f1a0",
   "LocalTransform":
    "Position":
     "X": -32,
     "Z": -32
    "Scale":
     "X": 38,
     "Y": 38,
     "Z": 38
   "Name": "envprobeROW1a",
```



```
"ProbeOffset":
     "X": 0.000125885009765625,
     "Y": 9,
     "Z": -15.9998779296875
    "ProxyDistNegX": 0,
    "ProxyDistNegY": 0,
    "ProxyDistNegZ": 0,
    "ProxyDistPosX": 0,
    "ProxyDistPosY": 0,
    "ProxyDistPosZ": 0,
    "TextureAsset":
"levels\\l20_City\\openArea\\Open_
World\\Tile_L34\\envprobes\\0x8f101
0910470f1a0.texture",
    "Type": "kRuntime",
    "VolumeShape": "kCuboid"
```















S S .

Model drawlist linked: 94% (Impostor drawlist linked: 100% # Zones Visible: 1

atmosphere_1gt.zone





(390 Mode

Display Env Probe Spheres Off Bypass Env Probe Color Coding Off Display Env Probe Mip 0

Display Env Probe Slot 2 Freeze Runtime State &RenderFace2 Visualize Drawlist Impostors Off Dump Drawlists to TTY

Bypass non-Env Probe-models Off Bypass hibernate models Off Bypass model Com sasters On Jags

Env Probe Render Mode Env Probe Mode caching Visible Weighting imit Step Once Per Frame Invalidate Sached Env Probes

Avg CPU microseco GPU micre itime E

100% (3)

at -160.0 0.0 1248.0

© 2019 Insomniac Games, Inc

(Care)	- 10	in a	See.
EII	A h	10	DE.

Specular Samples Off

Milp Bias 1.50 Impostors Only Respect Probe Types (default) 0.200 OF

dit EnvProbes

Display Env Probe Spheres Off Bypass Env Probe Color Coding Off Display Env Probe Mip 0

Display Env Probe Slot 2 Freeze Runtime State &RenderFace Visualize Drawlist Impostors Off Dump Drawlists to TTY

Bypass non-Env Probe-models Off Bypass hibernate models Off Bypass model CSW sasters On Jags

Env Probe Render Mode Env Probe Mode caching Visible Weighting Probe imit Step Once Per Frame

> Avg CPU microseco GPU micro itime E

100% (2)

Probe at -160.0 0.0 1248.0

© 2019 Insomniac Games, Inc

F	'n	v	P	in:	Ċ,	h.	=
		-			-	-	-

Specular Samples Off

Milp Bias 1.50 Impostors Only Respect Probe Types (default) 0.200 Ofi Invalidate Sached Env Probes

udit EnvProbes

Probe at -160.0 0.0 1248.0

100% (36)

Display Env Probe Spheres Off Bypass Env Probe Color Coding Off Display Env Probe Mip 0

Display Env Probe Slot 2 Freeze Runtime State &RenderFace Visualize Drawlist Impostors Off Dump Drawlists to TTY

Bypass non-Env Probe-models Off Bypass hibernate models Off Bypass model Compasters On Jags

Env Probe Render Mode Env Probe Mode caching Visible Weighting imit Step Once Per Frame

Avg CPU microseco GPU micro ntime E

© 2019 Insomniac Games, Inc

EnvDroha				in .
	En	YP	1 rr	ha

Specular Samples Off

Milp Bias 1.50 Impostors Only Respect Probe Types (default) 0.200 Ofi Invalidate Sached Env Probes

udit EnvProbes

Technical Info

- Each face of the cube map is rendered at 512x512 resolution
- We take advantage of MIP mapping to convolve the cube map down five levels
- Each MIP level represents an amount of glossiness
- Regardless of glossiness of the surface, the final result is quantized to one of the convolved MIPs

IG-Impostors

- Always maintain fidelity under all circumstances
- Eliminate far clipping plane draw-in
- Maintain geometric relief details of the source assets
- Support fully emissive and reflective surfaces
- Transition as seamlessly as possible between high-res instanced geometry and the corresponding IG-Impostor.
- Inform other game systems using the persistent IG-Impostor cache © 2019 Insomniac Games, Inc

IG-Impostors

High LOD Geometry

Points: 109822POINS: 152411Model Inst: 1611

High LOD Geometry

Points: 109822 Polys: 152411 Model Inst: 1611

High LOD Geometry

Points: 109822 POlys: 152411 Model Inst (unique): 76

© 2019 Insomniac Games, Inc

Points: 109822PONS: 152411Model Inst: 1611

© 2019 Insomniac Games, Inc

Geometry

Points: 55972 Polys: 92399 Model Inst: 55972

Points: 24562 Polys: 28134

Occluded Geometry

Points: 8352 Polys: 5445

Occlusion Removal

Points: 11338 Polys: 9526

IG-Impostor Geometry – Final Optimize

Points: 6712 Polys: 4999

© 2019 Insomniac Games, Inc.

IG-Impostor Texture Capture

© 2019 Insomniac Games, Inc

IG-Impostor Texture Capture

© 2019 Insomniac Games, Inc

IG-Impostor Texture Capture

Impostor Zone Atlas

Impostor Zone (9 tiles)

Low LOD Impostor Zone (9 tiles)

MBA

033

M35

034

035

		6 -	ð X
ile 1 Brightness -1.64	- Lighting Condition - 👘 🕯 🕈	∰ © © © @ ∰	O level
	4	Outliner	0
		Tile_M34_light_grid.zone	(1/296 items)
		Type to filter	T- 4
		lightgrid_216_88_1160	A
		lightgrid_232_8_1160 lightgrid_232_8_1176	
		lightgrid_232_8_1192	
		lightgrid_232_8_1224	
		lightgrid_232_8_1240	_
		lightgrid_232_8_1272	
		lightgrid_232_24_1160	_
8 33		lightgrid_232_24_1192	
		lightgrid_232_24_1208 lightgrid_232_24_1224	_
		lightgrid_232_24_1240	_
		lightgrid_232_24_1256 lightgrid_232_24_1272	
and the second s		lightgrid_232_40_1160	
		lightgrid_232_40_1176 lightgrid_232_40_1192	
		lightgrid_232_40_1208	
		lightgrid_232_40_1224 lightgrid_232_40_1240	_
		lightgrid_232_40_1256	
		lightgrid_232_40_1272 lightgrid_232_56_1160	
		lightgrid_232_56_1176	-
		lightgrid_232_56_1208	- 1
the second secon		lightgrid_232_56_1256	_
		lightgrid_232_72_1160	
	LIB M	lightgrid_232_72_1176 lightgrid_232_72_1192	_
	19166	lightgrid_232_72_1208	
	1. State -	lightgrid_232_88_1160 lightgrid_248_8_1160	
		lightgrid_248_8_1176	
		lightgrid_248_8_1192 lightgrid_248_8_1208	
Letter / 1/2 manage		lightgrid_248_8_1224	_
	-	lightgrid_248_8_1240 lightgrid_248_8_1256	
	- a Frate - m	lightgrid_248_8_1272	
		lightgrid_248_24_1176	
		lightgrid_248_24_1192	_
	And the second second	lightgrid_248_24_1224	
		lightgrid_248_24_1240	1
		lightgrid_248_24_1272	
		lightgrid_248_40_1160	_
		lightgrid_248_40_1192	12
and the second s		lightgrid_248_40_1208 lightgrid_248_40_1224	
		lightgrid_248_40_1240	
		lightgrid_248_40_1256 lightgrid_248_40_1272	
		lightgrid_248_56_1160	
		lightgrid_248_56_1272	
1000 FPS:29 PID:72028		lightgrid_248_72_1160	
wi 💷 Ni 💵 🔤 📑 📶 🎛 🕥 🔙	🥰 🛓 🕑 🞬 🥝 🖄	G	6:06 PM 3/6/2019

"AssetType": "kLightGrid", "ld": "0x800c86068122161b", "LocalTransform": "Position": "X": 24, "Y": 24, "Z": 1192 **}**, "Scale": "X": 8, "Y": 8, "Z": 8 EST.1994 -----

© 2019 Insomniac Games, Inc.

Technical Info

- 4096 samples per capture volume
- Each sample generates a cube map at 256x256 pixels per face
- Each face of the cube map is convolved down to a single HDR color value representing the diffuse term and a directional vector
- Color value and direction data is highly compressible

© 2019 Insomniac Games, Inc.

SPJDER-MAN

Thanks!

