IG3D
Deep Shadow Maps

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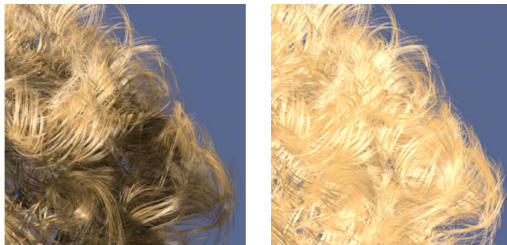
April 15, 2024

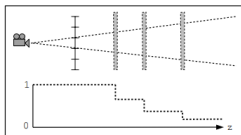# Contents

About the Article

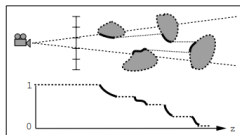*Figure 1: Hair rendered with and without self-shadowing.*

Why not traditional Shadow Maps?

- Requires very high resolution
- Don't support volumetric objects
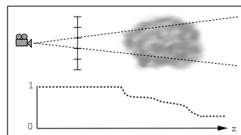- Don't support semi transparent objects

What exactly are deep shadow maps?
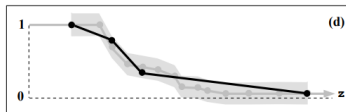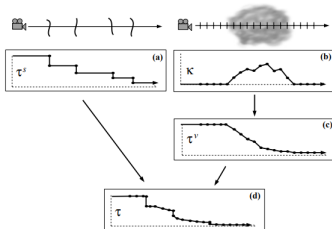

(a) A stack of semitransparent objects

(b) Partial coverage by opaque blockers
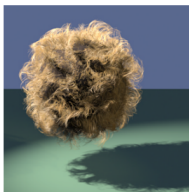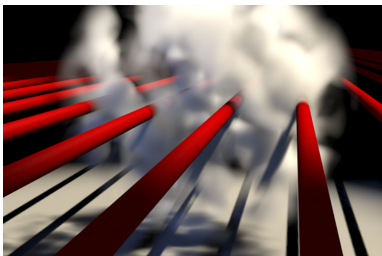
(c) Volume attenuation due to smoke

Visibility Function

Transmittance Function

Visibility Function compression

Original Results

(a) Ball with 50,000 hairs   (b) 512×512 Normal shadow map   (c) $4k \times 4k$ Normal shadow map   (d) 512×512 Deep shadow map
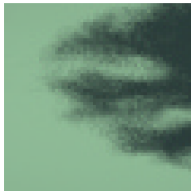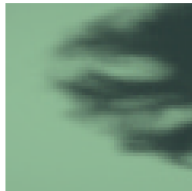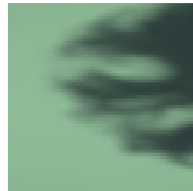
Traditional and deep shadow map comparison

Implementation

- Implemented on my ray tracer from lab session with some adjustments
- Added new type of objects such as plane rectangle, cylinder and **volumetric object**
- Define the volume object with density (variant of Perlin noise)
- Ray marching for light absorption, visibility function for in scattering calculation
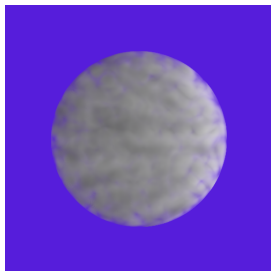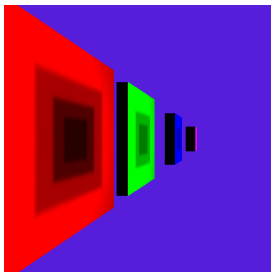

Shadows with ray marching
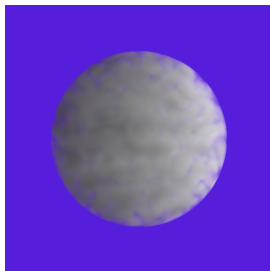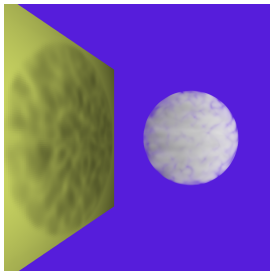
Self shadowing with averaging Filter
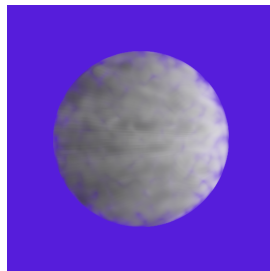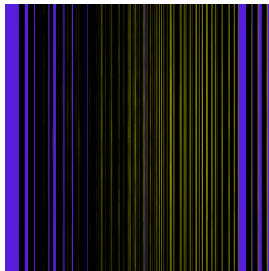
Self Shadowing without averaging filter

My Results

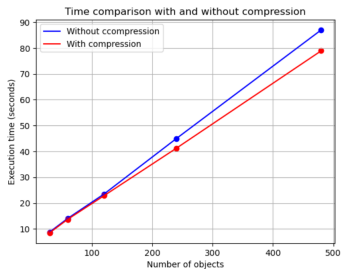Semi transparent shadows

Shadow cast from volumetric object to surface
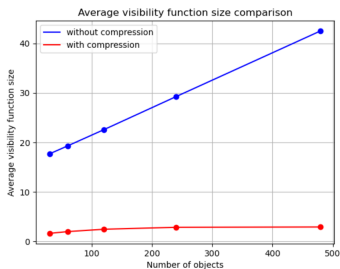

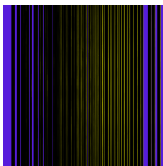Partial Coverage by Opaque objects

Compression Efficiency

Time Comparison

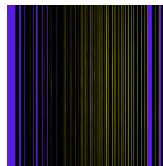

Space Comparison

With Compression

Without compression

Limitations

Some problems to render hair:

- Usually represented with quadratic or cubic Bezier Curve
- No analytical solution to find ray intersection
- Can be presented with polygons but computationally too expensive
- Need more research on the subject
- Used thin cylinders to test the case of partial coverage by opaque objects

Conclusion and Future Work

Deep Shadow Maps are

- great for rendering realistic shadows of Volumetric and semi transparent objects
- efficient to render shadows of hair and fur
- great project to learn c++

As future work I am interested in exploring

- motion blurred shadows
- mipmapnig
- rendering techniques for hair
- a GPU implementation to increase the speed (maybe real time?)

Thank you!