

Can we compute the free-will?



Changkun Ou

changkun.de/s/polyred6fold

 @changkun

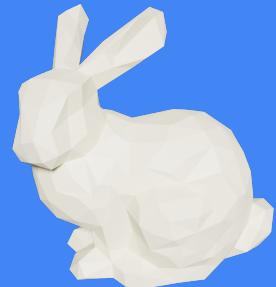
IDC 2021 Autumn
Venice, Italy
Oct 6, 2021

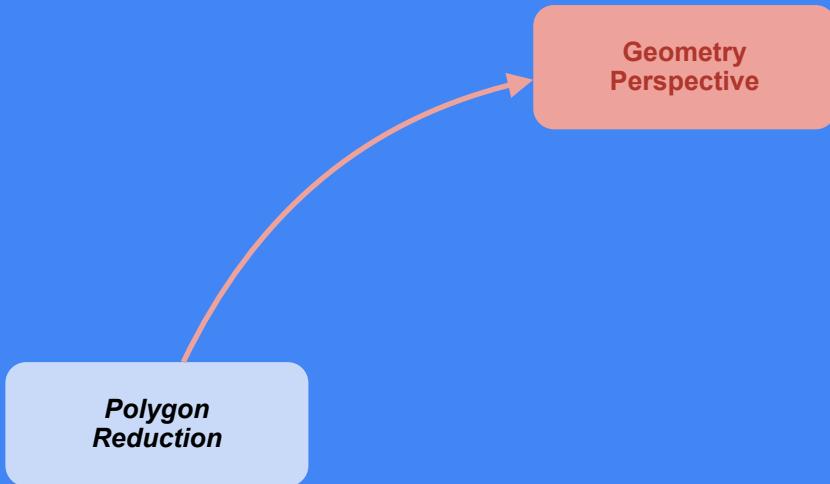


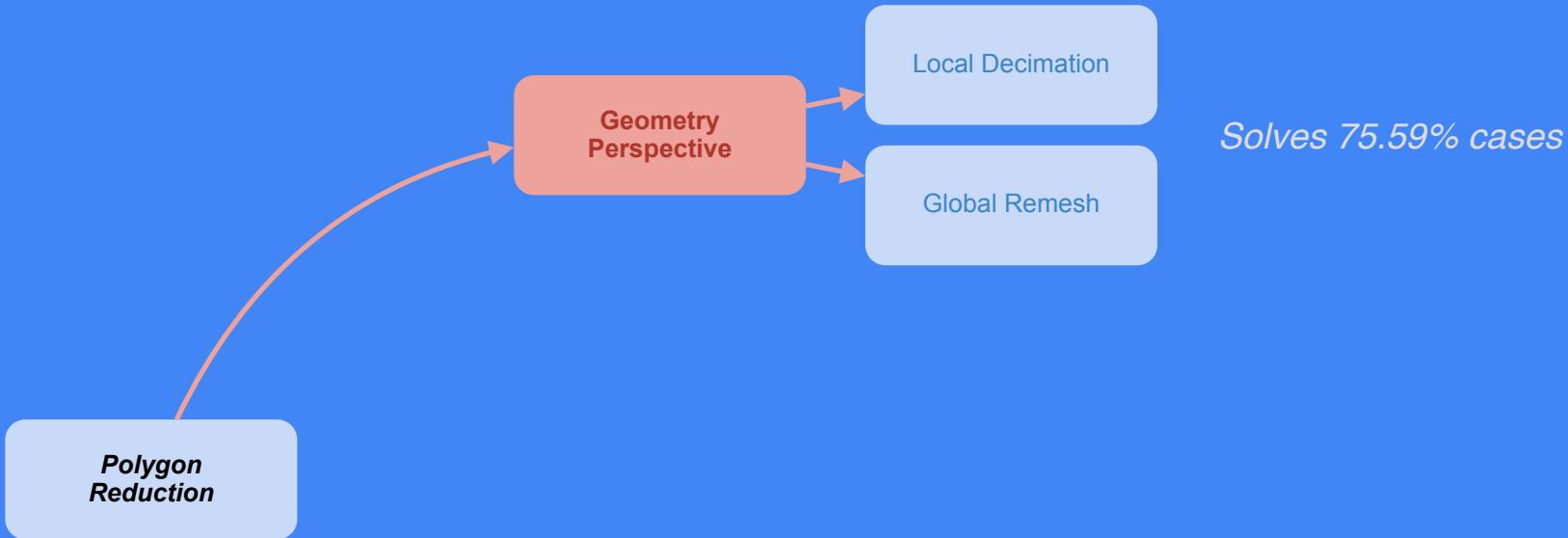
Background

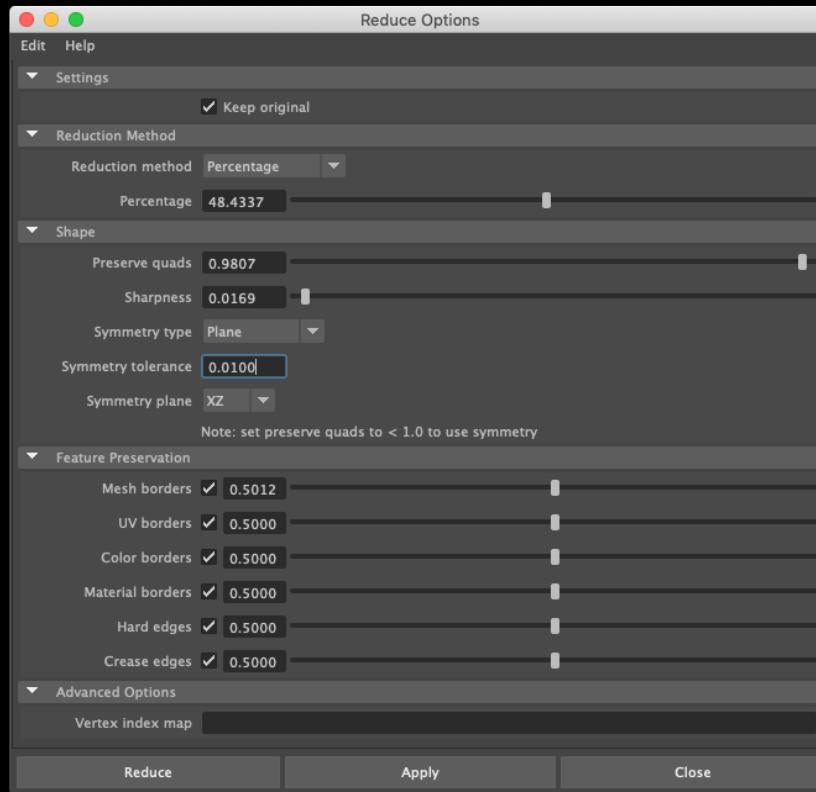
*Polygon
Reduction*

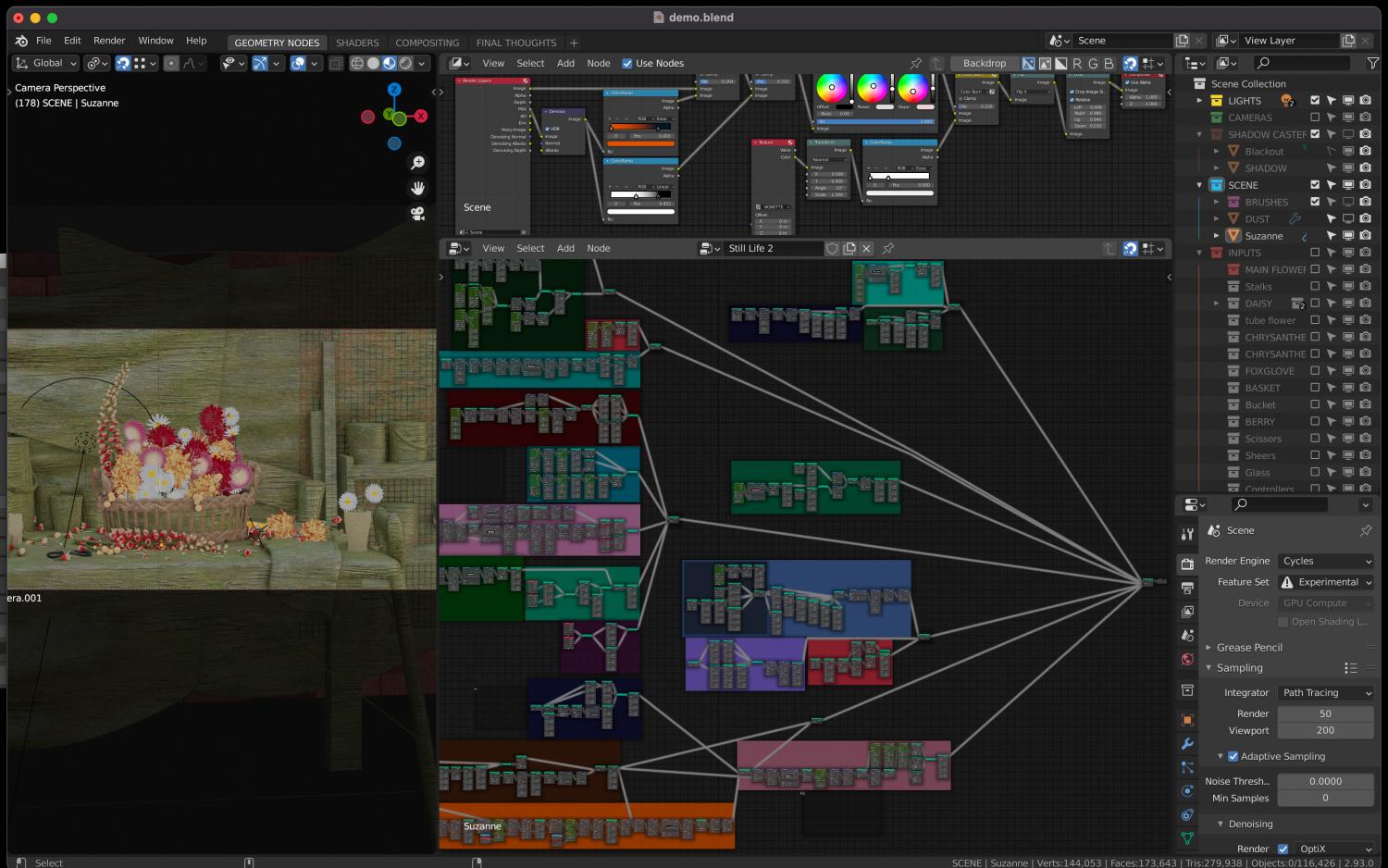
*Polygon
Reduction*











The Cornell Box Comparison [Candy et al 1984]

Which is the real?

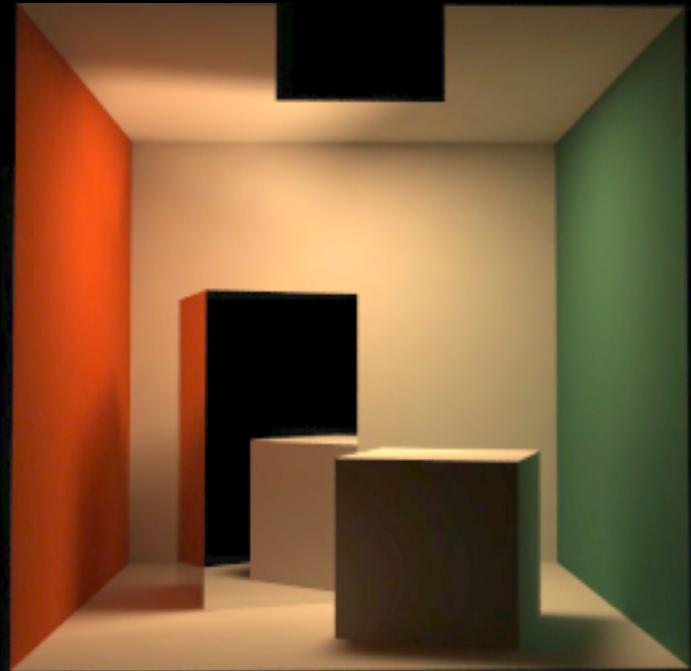


The Cornell Box Comparison [Candy et al 1984]

Which is the real?



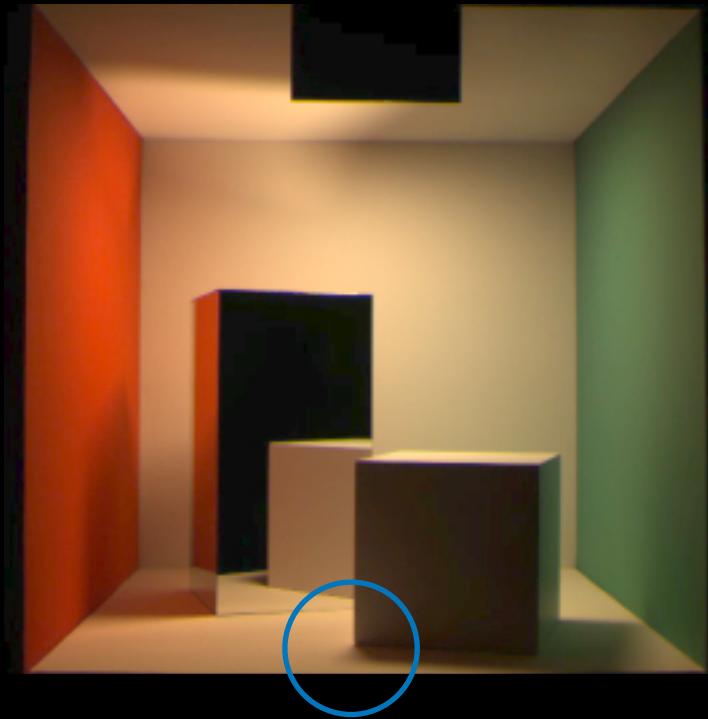
Photo (Measured)



Rendered (Simulated)

The Cornell Box Comparison [Cindy et al 1984]

Which is the real?



Turing test (Graphics Version)

“If everything looks correct, then it is correct.”



-20.0%

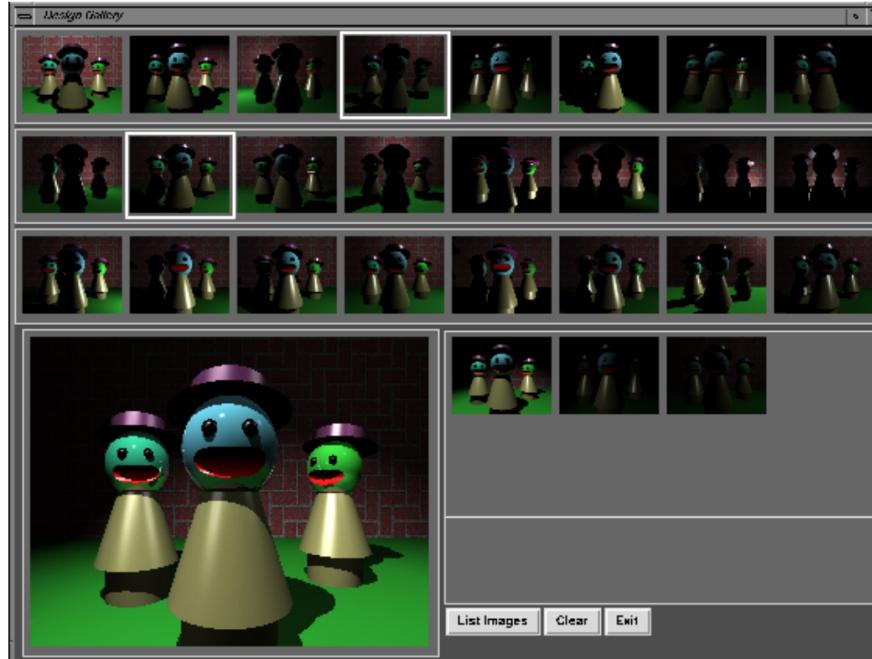


-89.4%

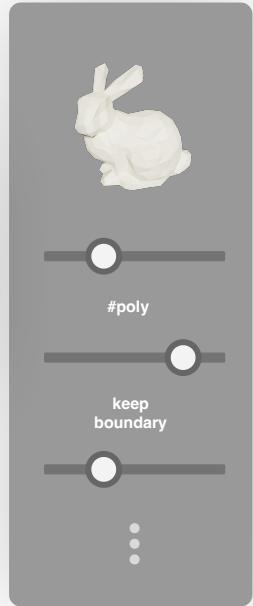
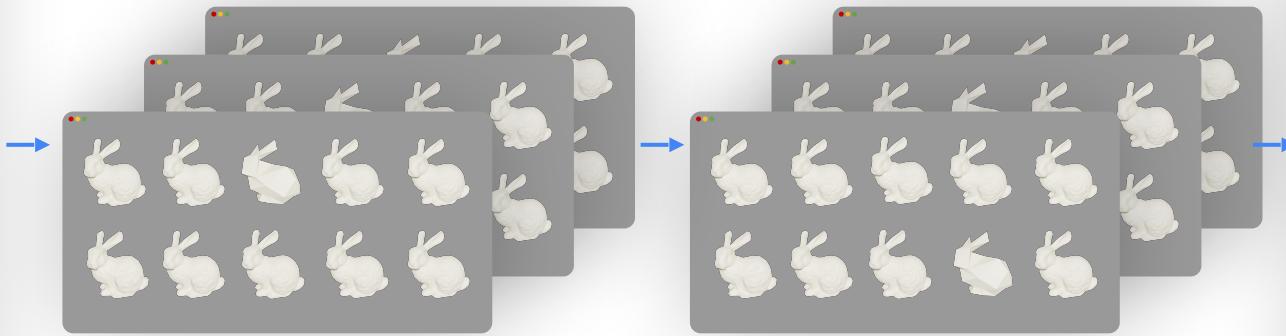
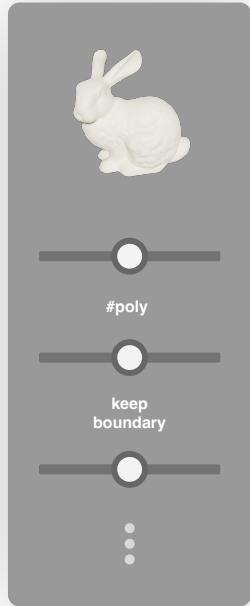
Human-in-the-loop?

Design Galleries

[Marks et al. 1997]



Geometry Galleries





“Human-in-the-loop” Polyred

**Rate from 1~5 for each model
(1=worst, 5=best)**

Run



“Human-in-the-loop” Polyred

**(1/5) Rate from 1~5 for each model
(1=worst, 5=best)**

-99.5%



-90.0%



-50.0%



-20.0%



Evaluate



“Human-in-the-loop” Polyred

**(1/5) Rate from 1~5 for each model
(1=worst, 5=best)**

-99.5%



1

-90.0%



3

-50.0%



4

-20.0%



2

Evaluate



“Human-in-the-loop” Polyred

**(2/5) Rate from 1~5 for each model
(1=worst, 5=best)**

-99.0%



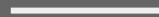
-95.0%



-80.0%



-60.0%



Evaluate



“Human-in-the-loop” Polyred

(5/5) Optimal Reduced Model:

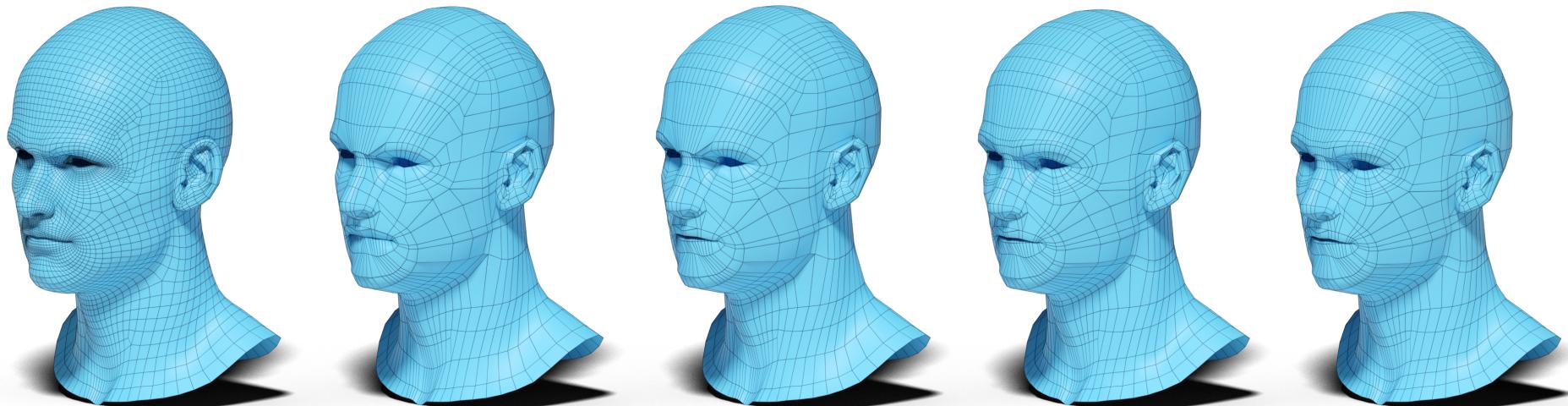
-89.4%



Done

How Good Is the Design? Will it Success at Scale?

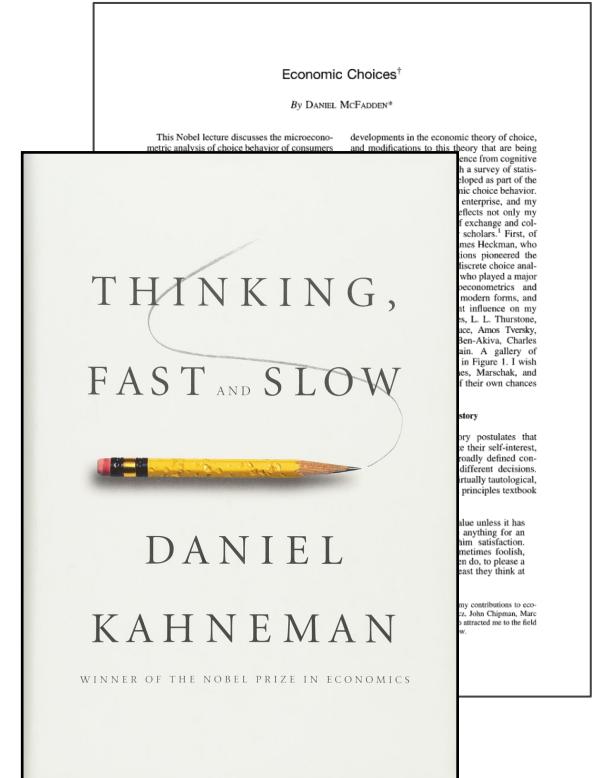
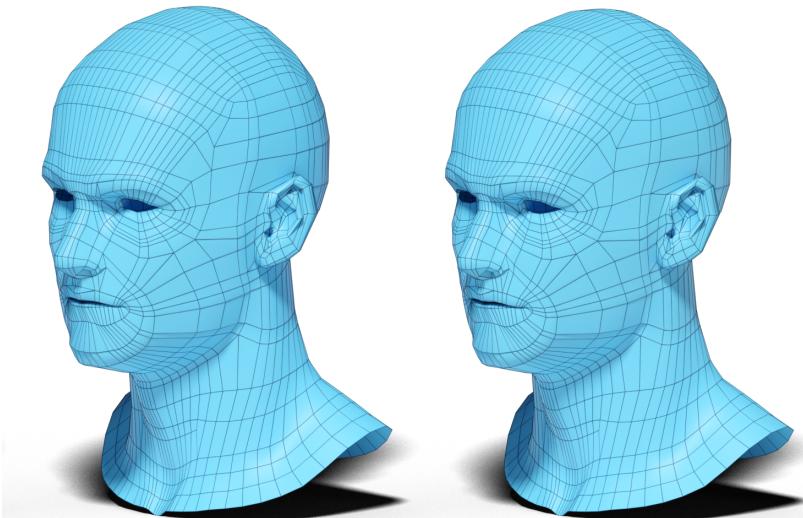
This is a similar and successful idea proven in XYZ, will it also success (at scale) for polyred?



Judgement under Uncertainty

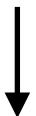
[A. Tversky and D. Kahneman 2002]

Which one do you prefer?



Rating Distribution

4, 2, 1, 1 (μ_1, σ_1)



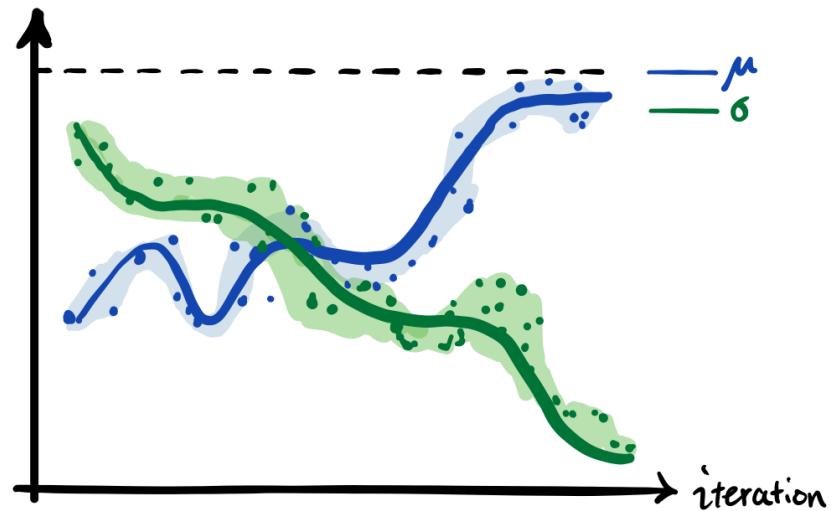
3, 4, 1, 2 (μ_2, σ_2)



5, 4, 2, 3 (μ_3, σ_3)



...



Rating Distribution

4, 2, 1, 1 (μ_1, σ_1)



3, 4, 1, 2 (μ_2, σ_2)

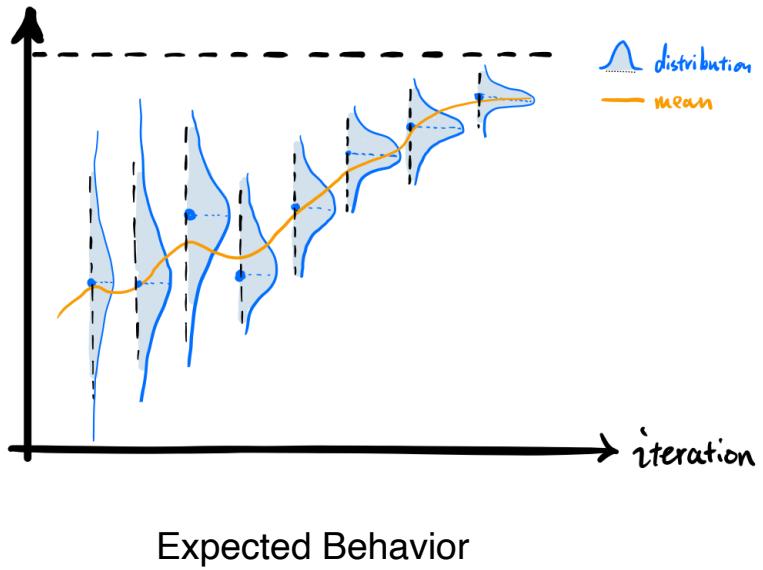


5, 4, 2, 3 (μ_3, σ_3)

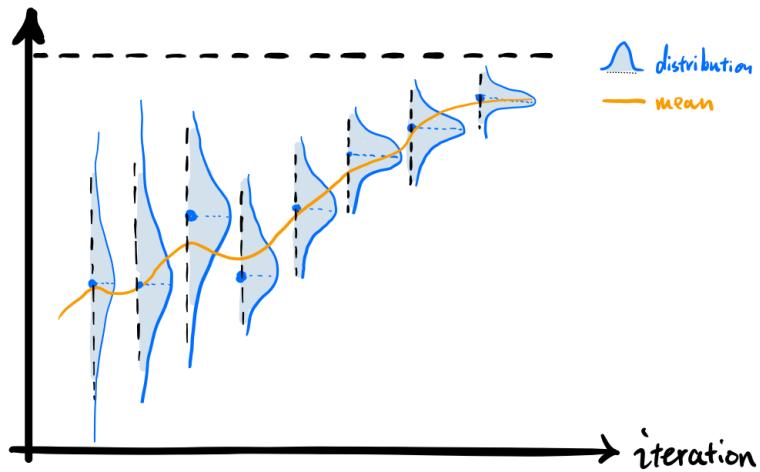


...

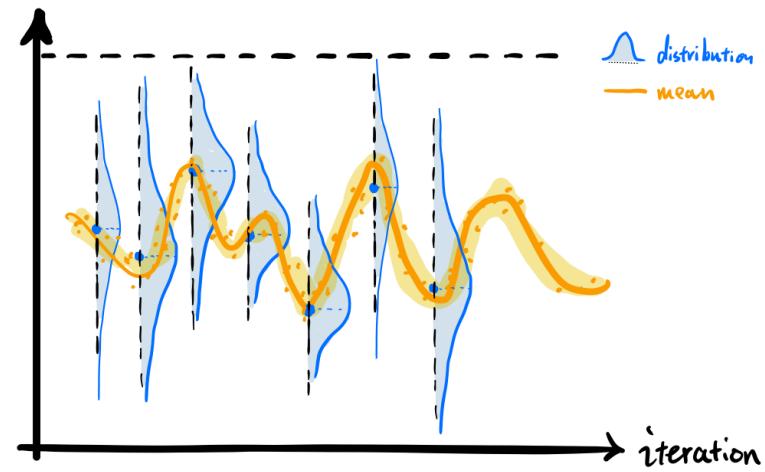
Expectation vs. Reality



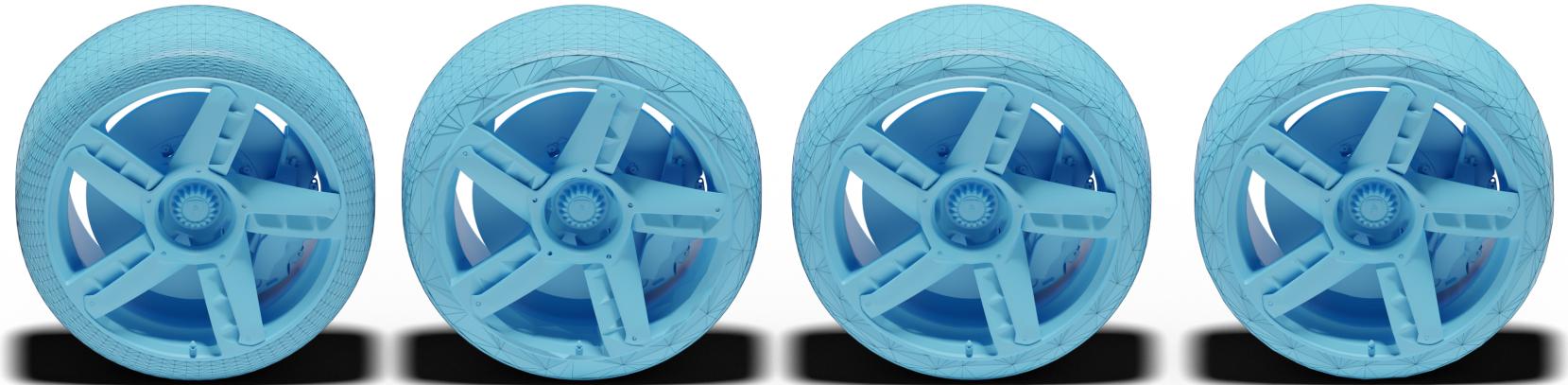
Expectation v.s. Reality



Expected Behavior

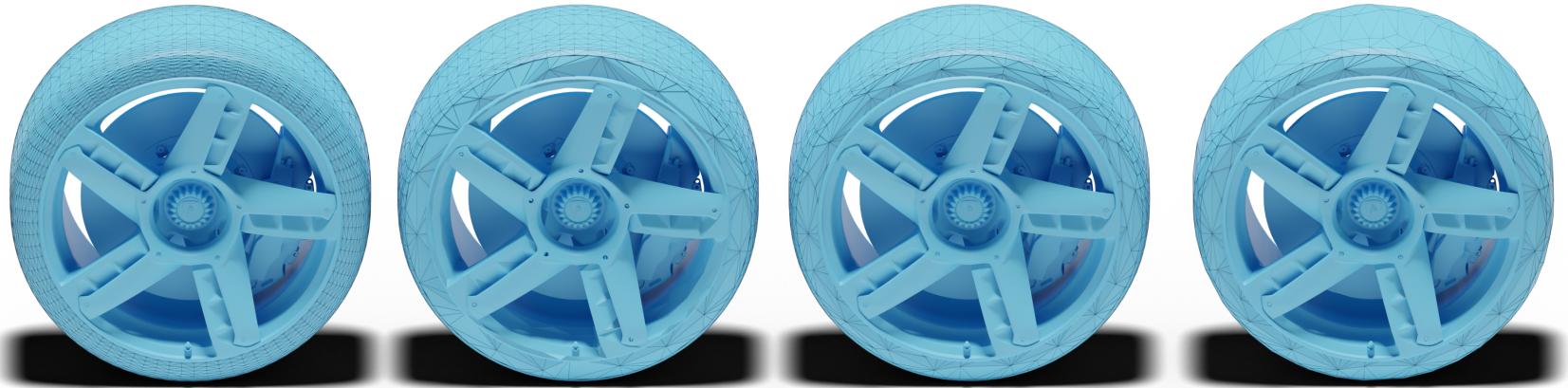


Actual Behavior



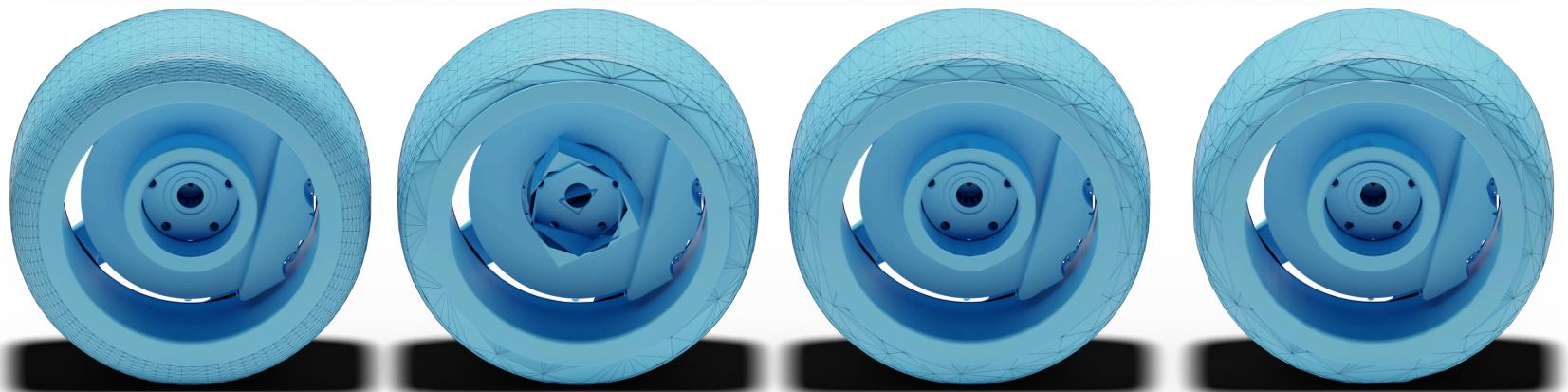
Base

5



Base

5



Rethinking Human Judgement

- Human judgements are
 - Erratic, Strong Local, Prior, Time- and Context dependent
 - Formally: non-Gaussian, non-Stationary
- The Free-will issue:
 - Can predictive models really work if we acknowledge we indeed have free-will?

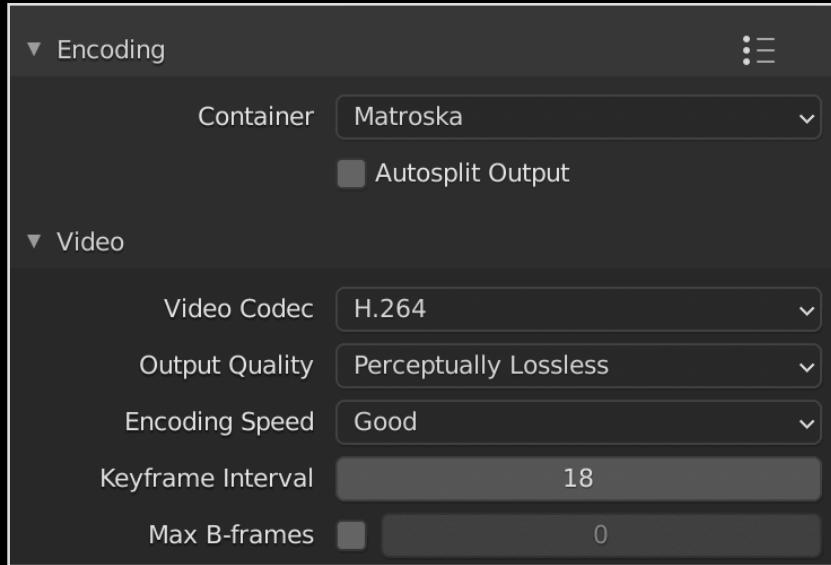
Do we really want care about meshing?

The Cornell Box Comparison

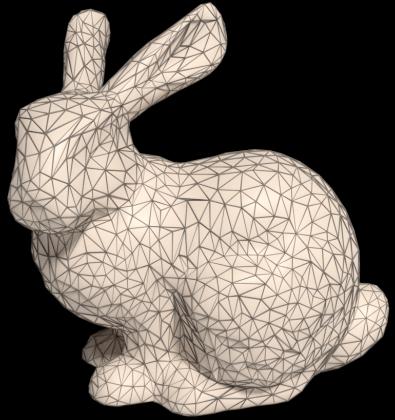
[Cindy et al 1984]



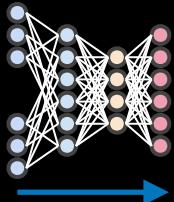
Replace Human's Perceptual?



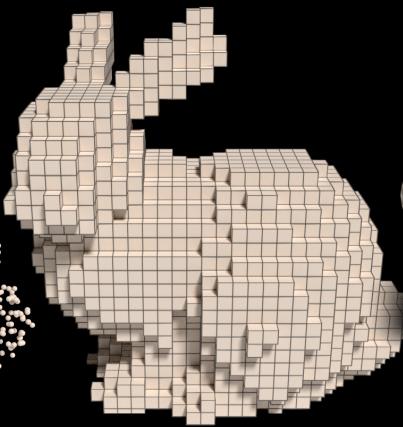
Peak Signal to Noise Ratio (PSNR)
Structure Similarity (SSIM)



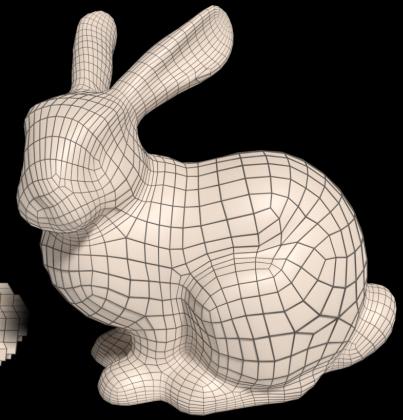
Original



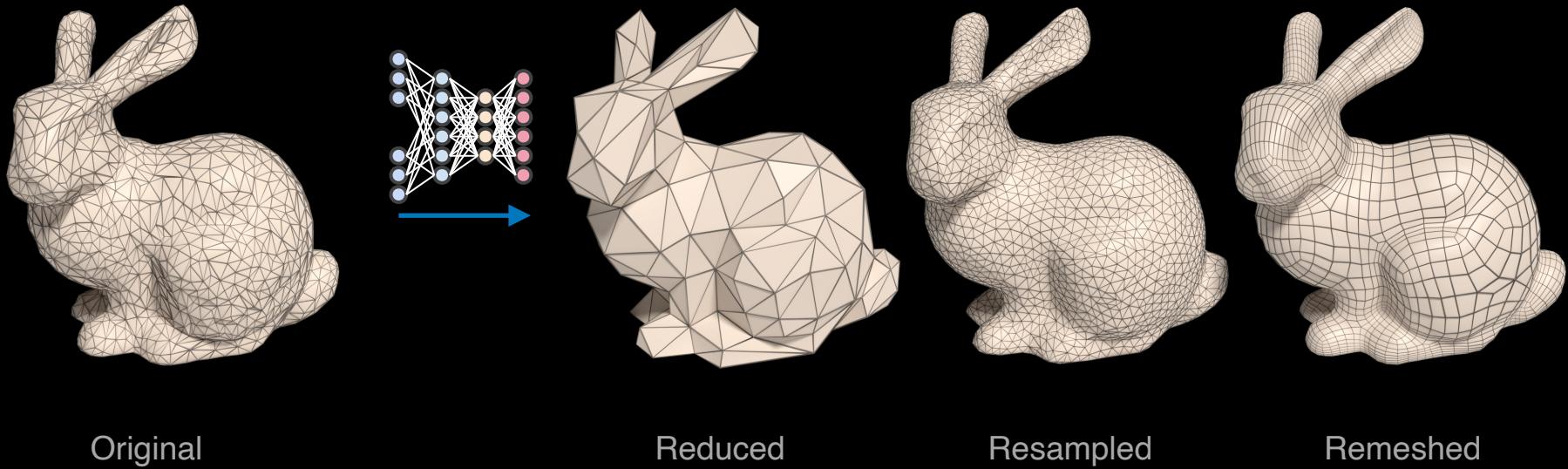
Point



Voxel



Mesh



The Objective



The Objective



The Objective



The Objective

$$L(\text{Rabbit Mesh}) = \|\text{Rabbit Mesh} - \text{Target Rabbit}\|^2$$

The Objective

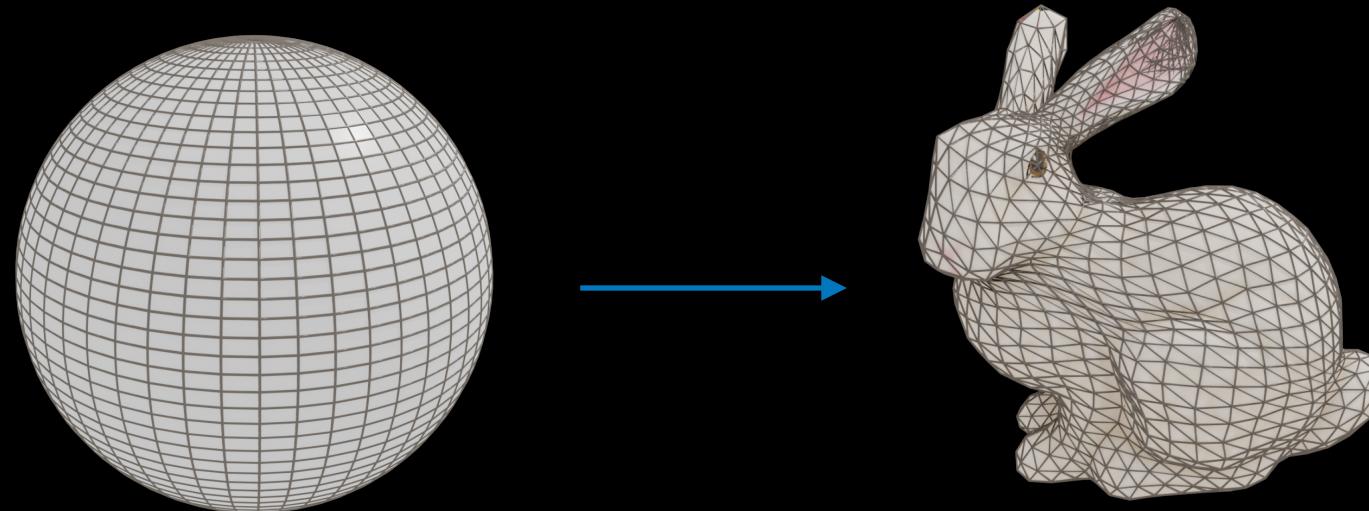
$$L(\text{mesh}) = \left\| \text{mesh} - \text{render} \right\|^2$$

$$\text{minimize } L(M(\mathbf{p}_1), r(\mathbf{p}_2))$$

↑
Objective Function ↑
Mesh Model ↑
Mesh Parameter s ↑
 ↑
Renderer Method ↑
 ↑
Render Parameters

Q: Where should we start?

Q: Where should we start?



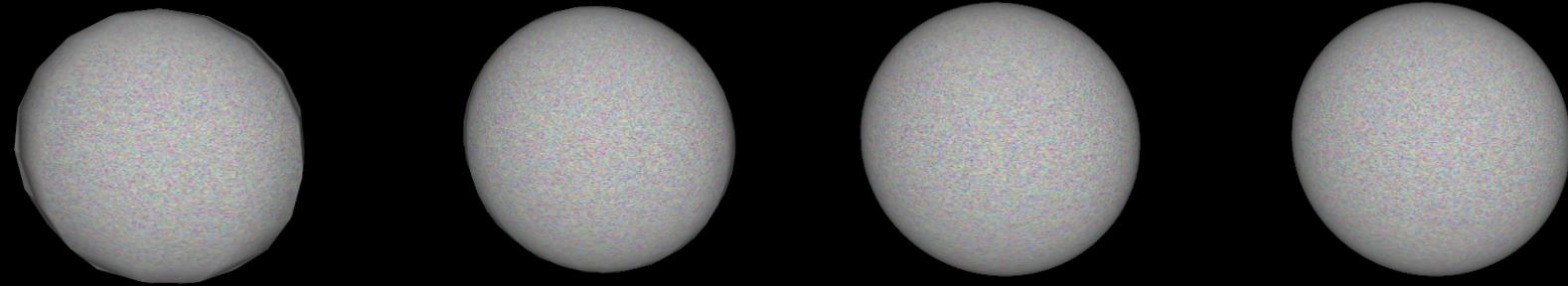
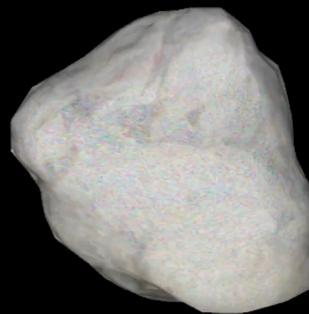


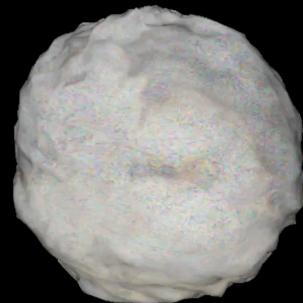
Image-driven



180 faces



760 faces

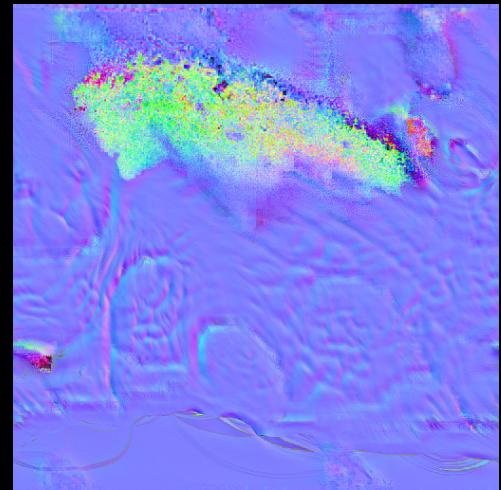
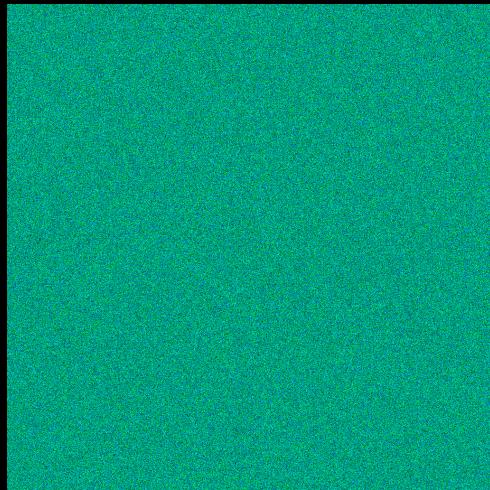


4900 faces



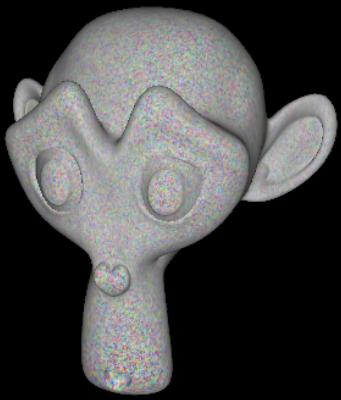
12640 faces

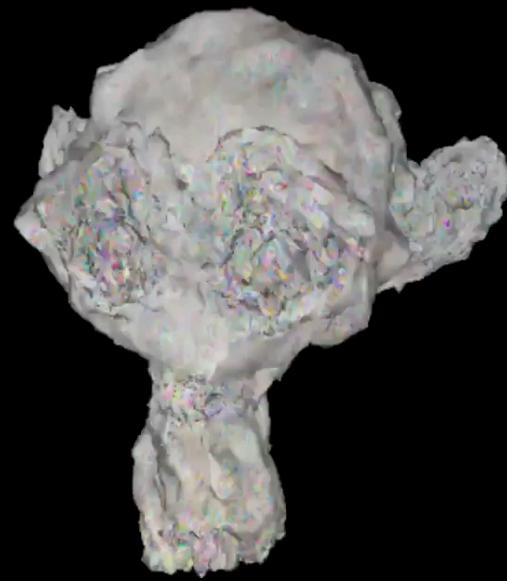
Learned Texture Maps

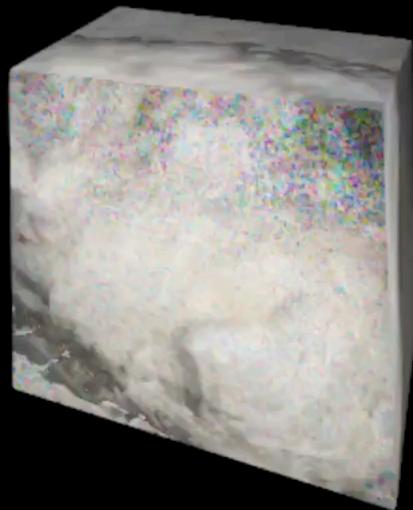
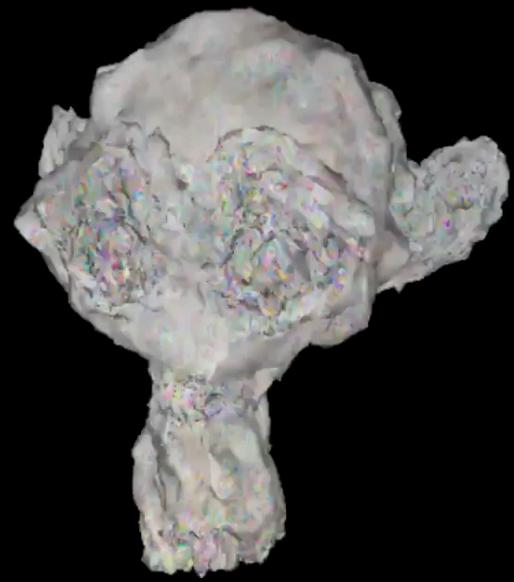


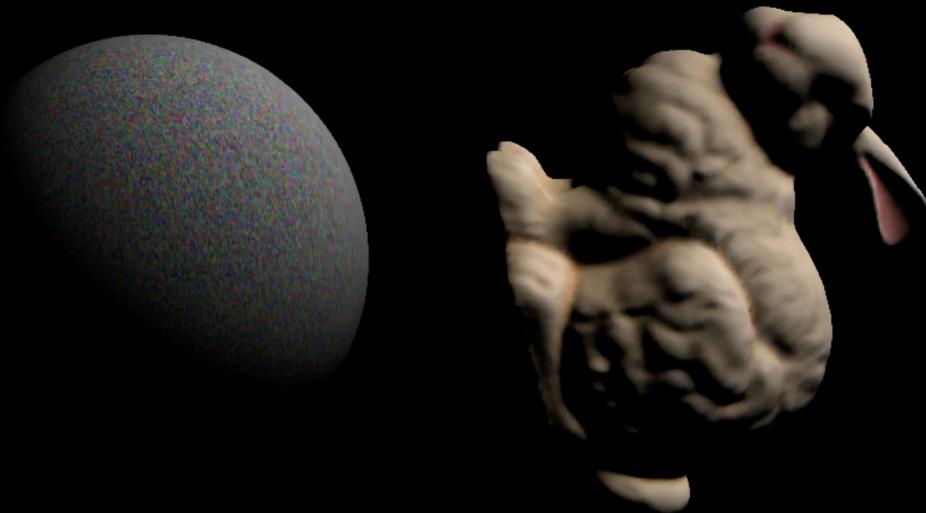
Q: Which is the original mesh?





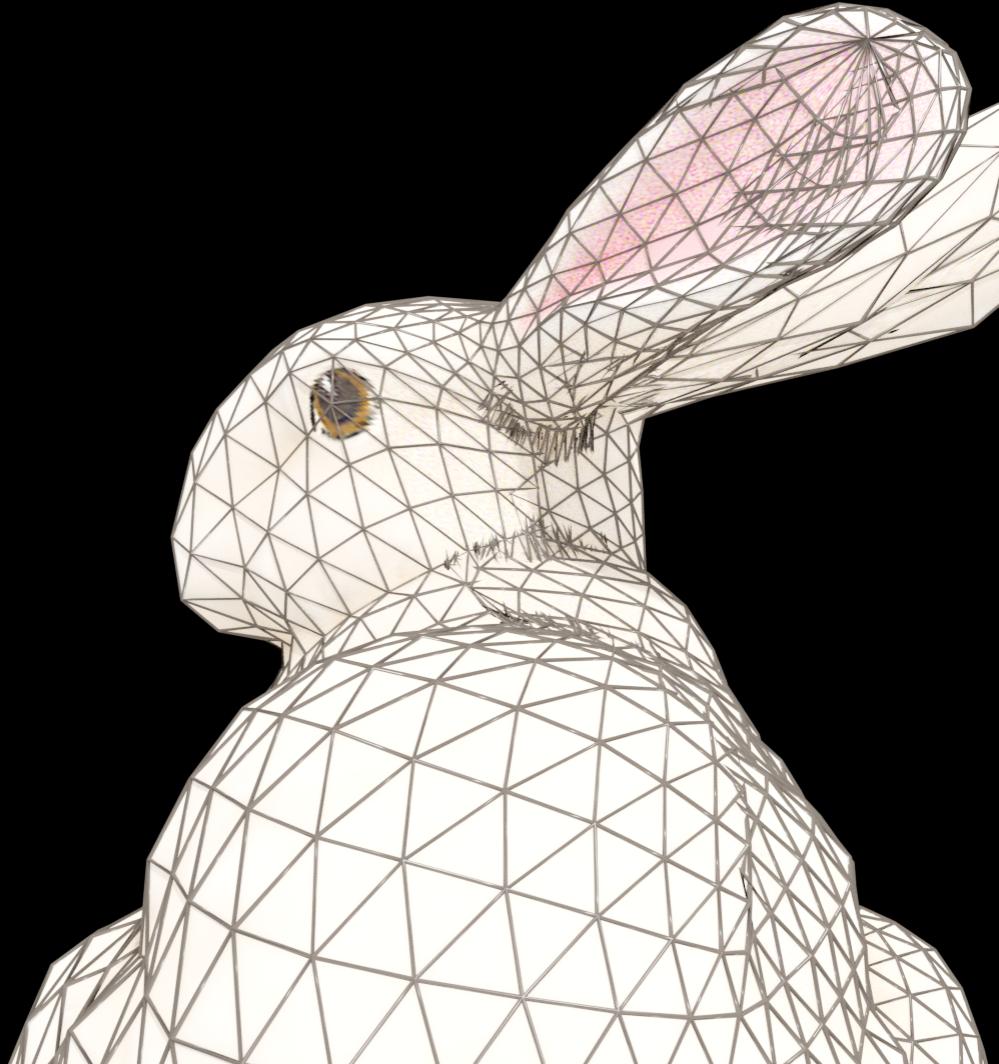




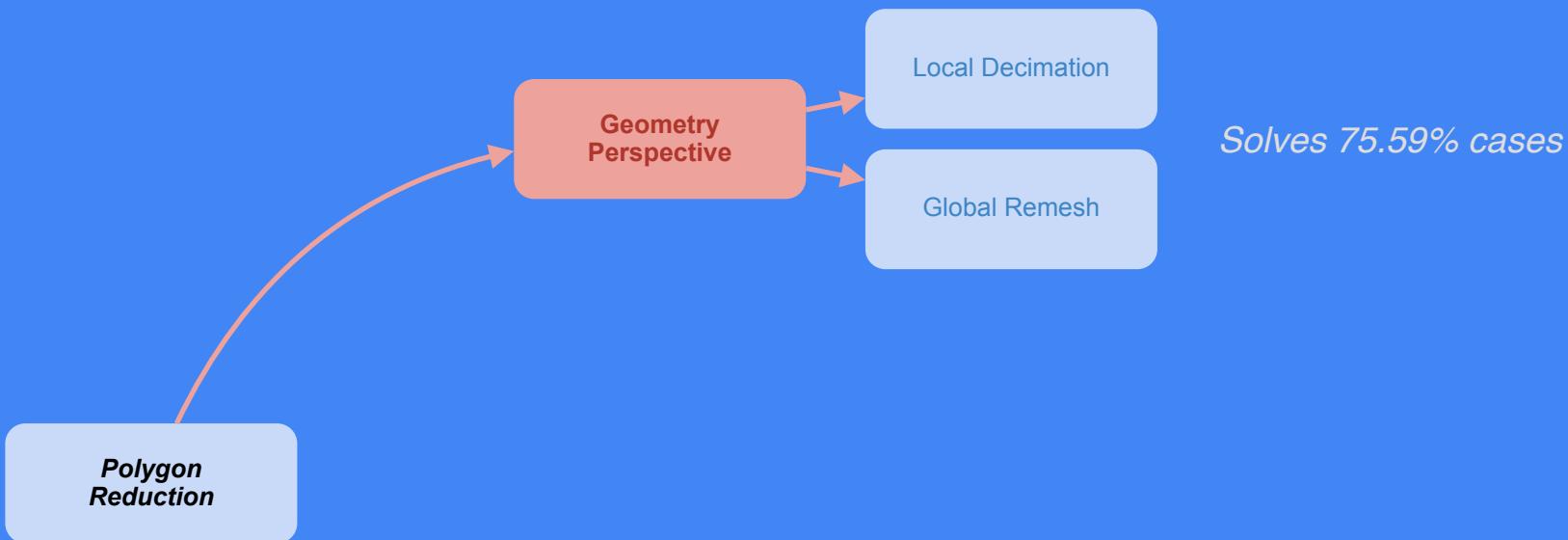


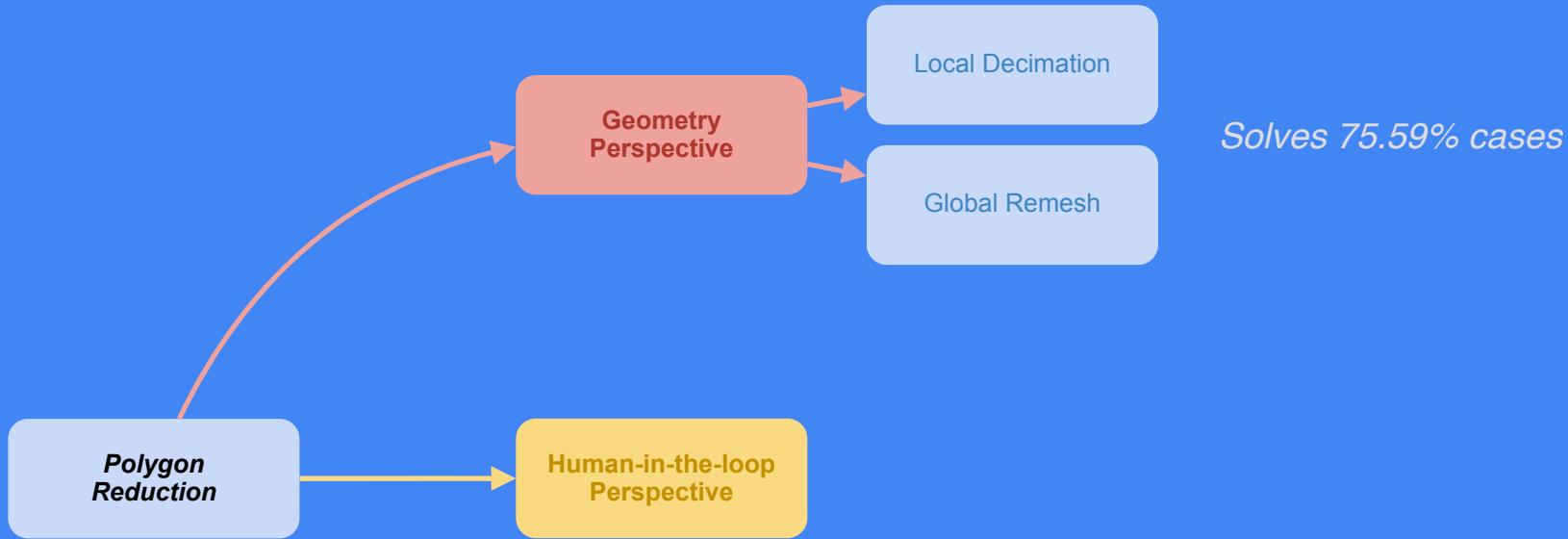
Issues:

1. Meshing is not good enough
2. Approximating may take longer than we thought
3. Determine a base mesh is difficult
4. Does not handle inside or non-visible region, etc.

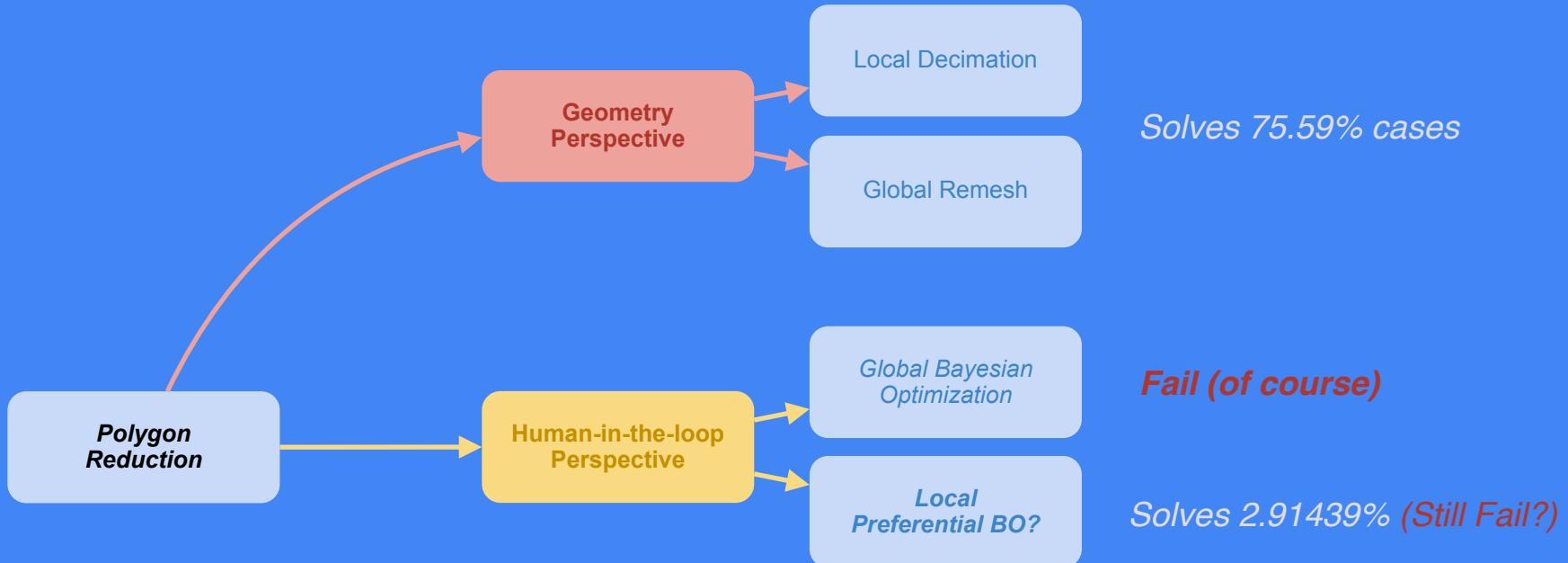


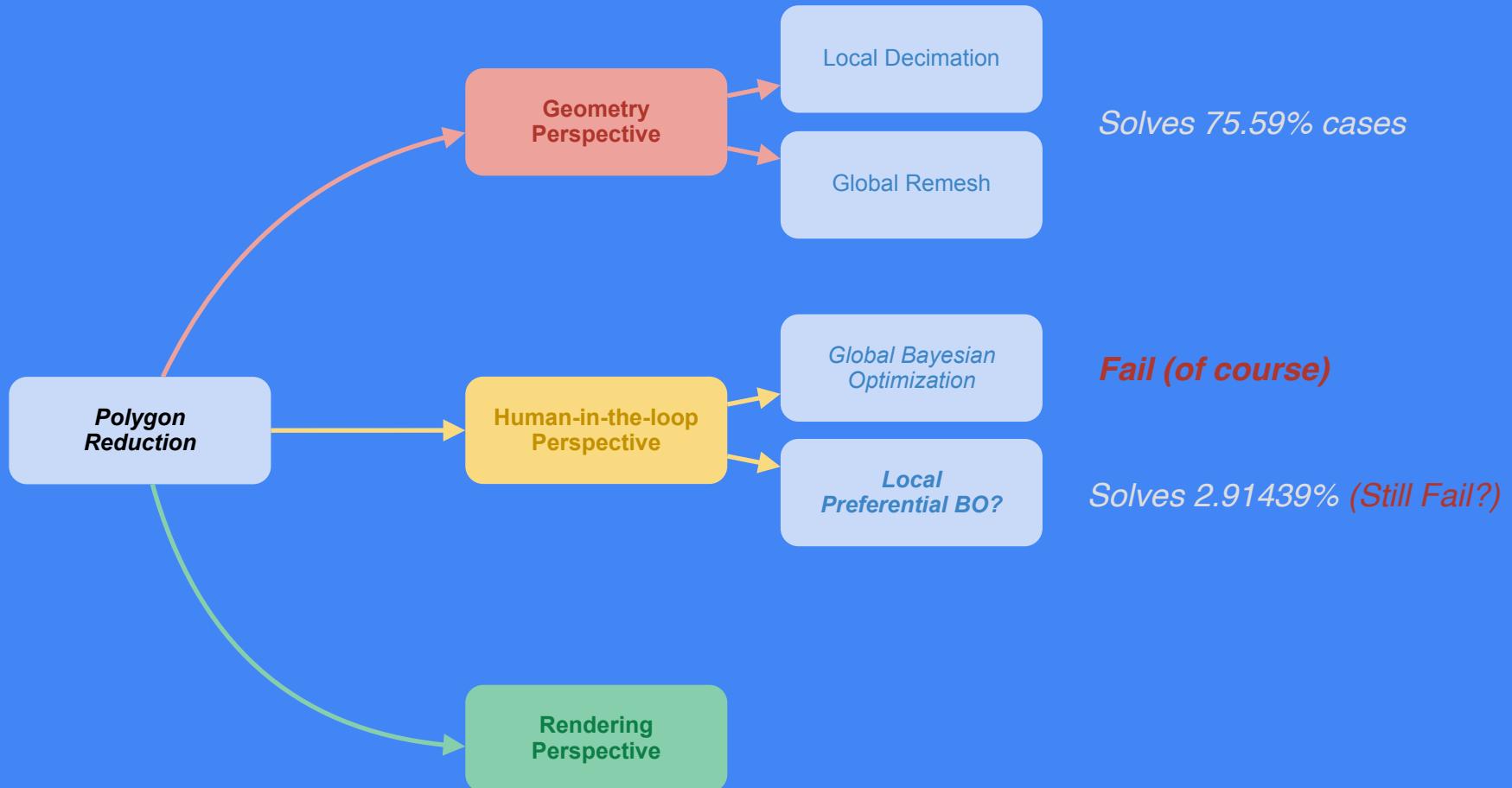
Summary

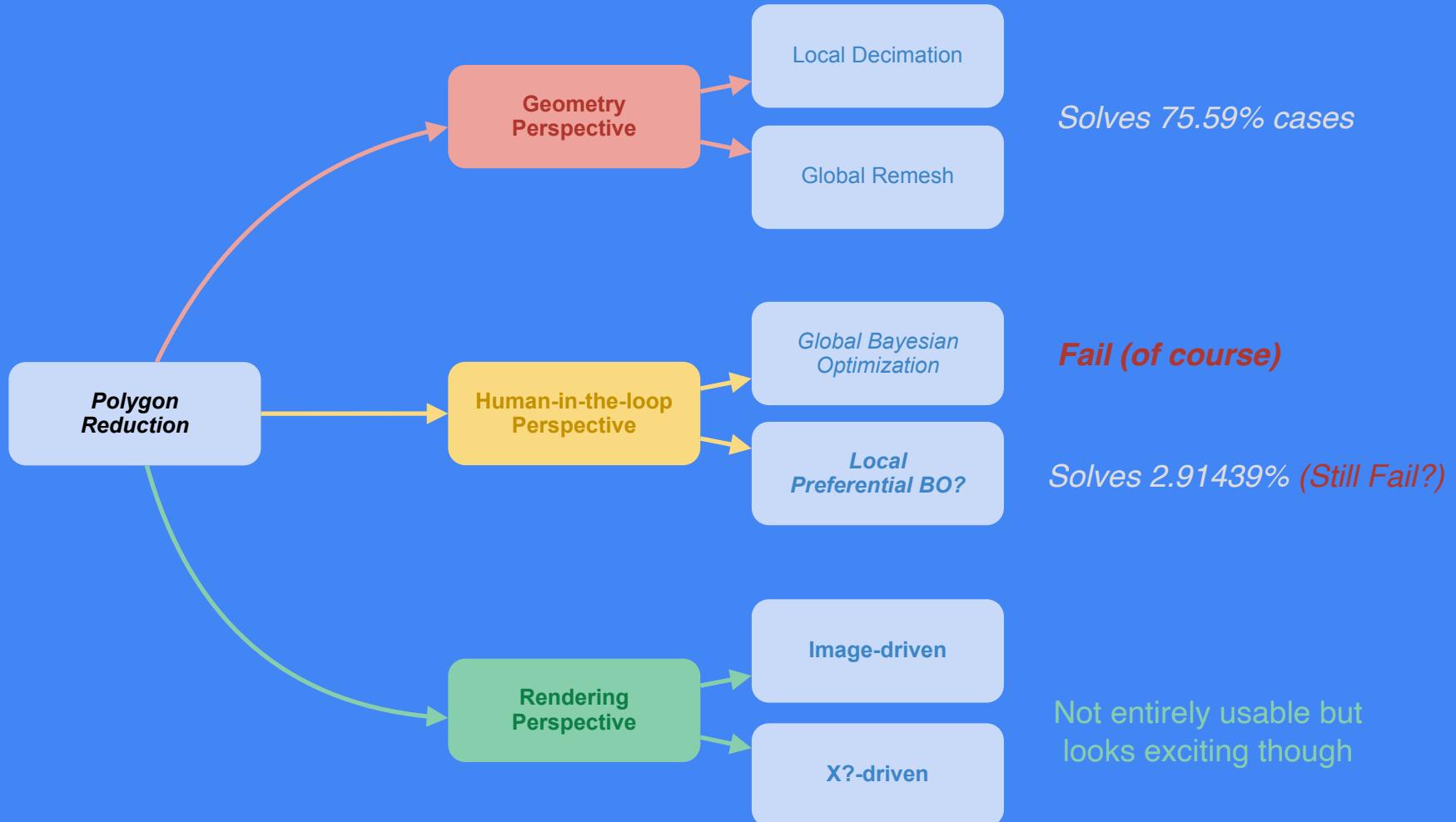




Solves 75.59% cases

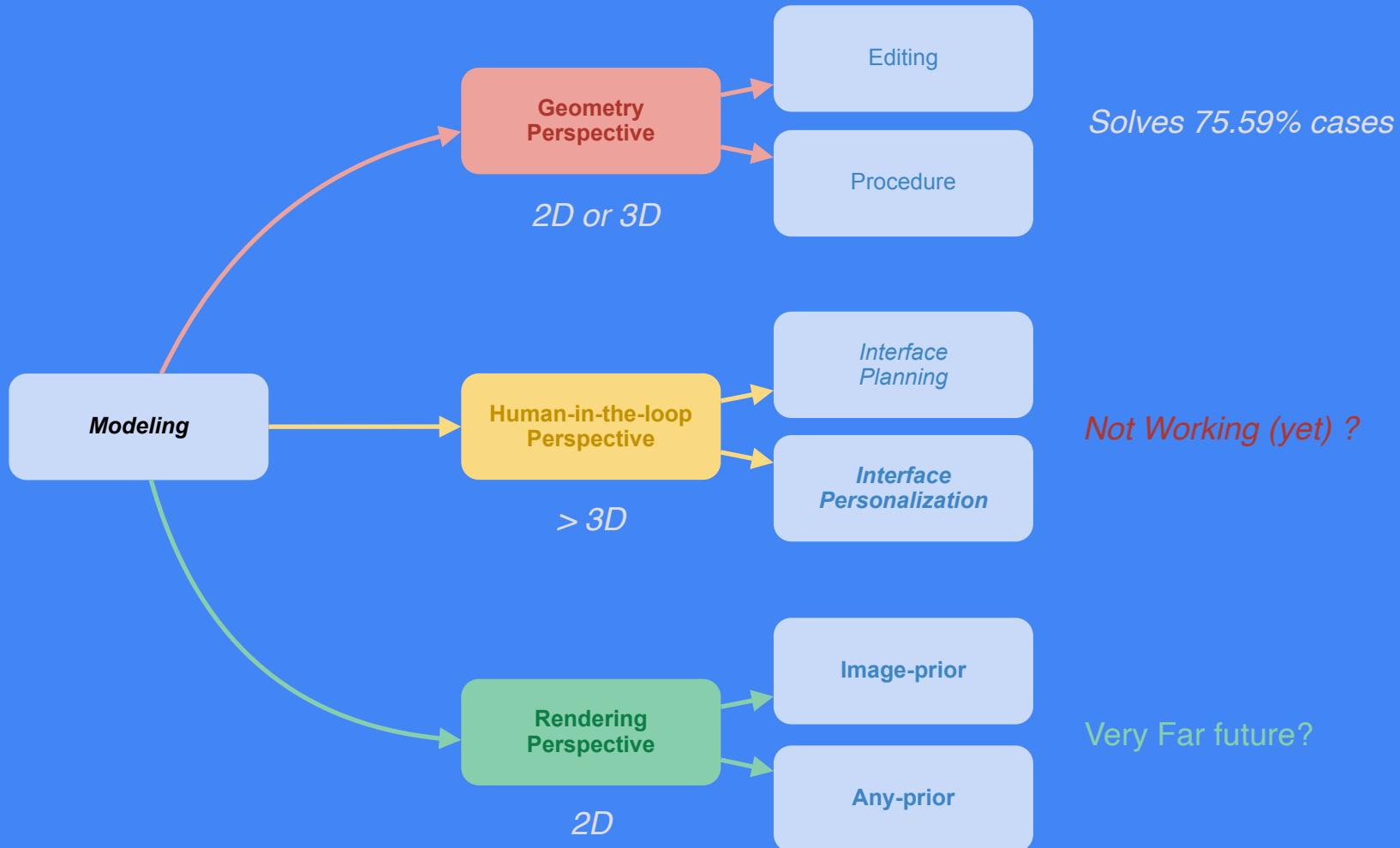






Bigger Picture





Discussion

- What else can we do
 - To simplify and hiding complexity from regular user?
 - If humans are unreliable to providing their feedback?
 - To improve the systems' effectivity and efficiency?
 - To identify “human-prior”?
 - To avoid the free-will issue?