

A detailed LEGO model of Venice, Italy, featuring the St. Mark's Basilica, the Campanile di San Marco, and various buildings along the waterfront. In the sky, there is a LEGO airplane, a helicopter, and a hot air balloon.

# Can we compute the free-will?

**Changkun Ou**

[changkun.de/s/polyred6fold](https://changkun.de/s/polyred6fold)

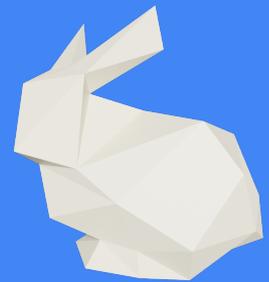
 @changkun

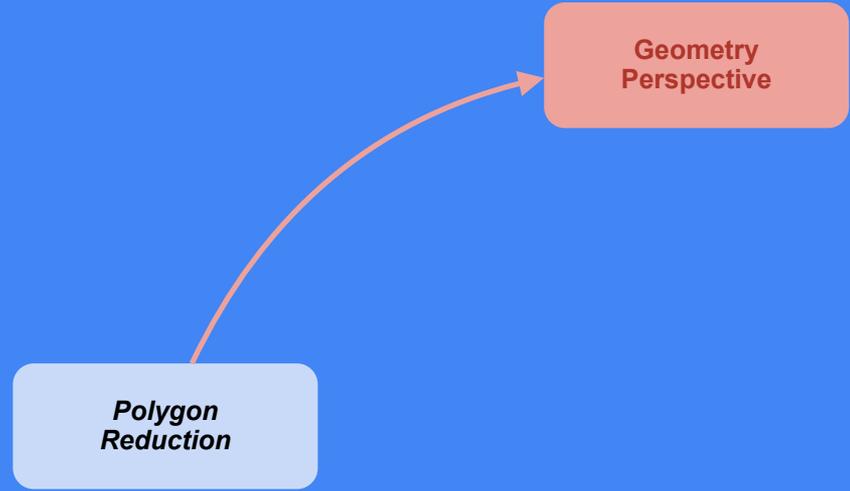
IDC 2021 Autumn  
Venice, Italy  
Oct 6, 2021

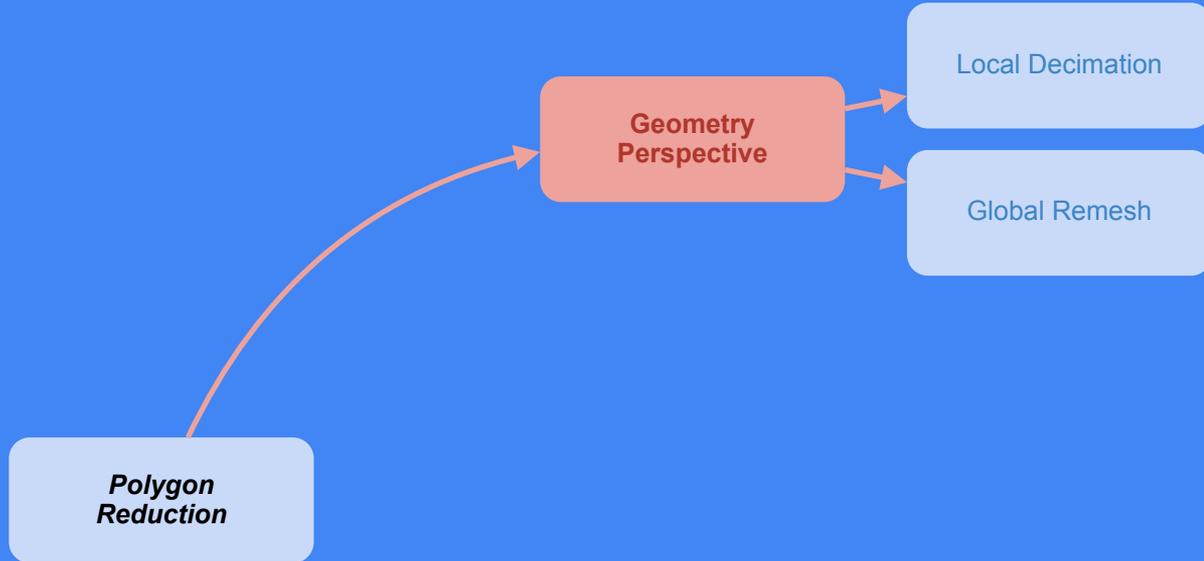
# Background

***Polygon  
Reduction***

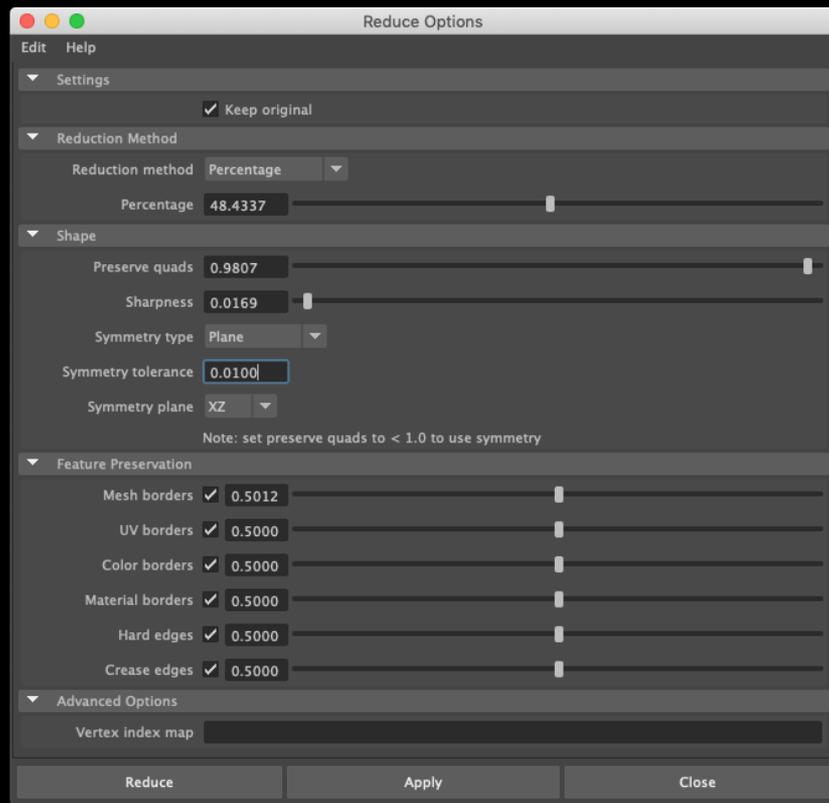
***Polygon  
Reduction***

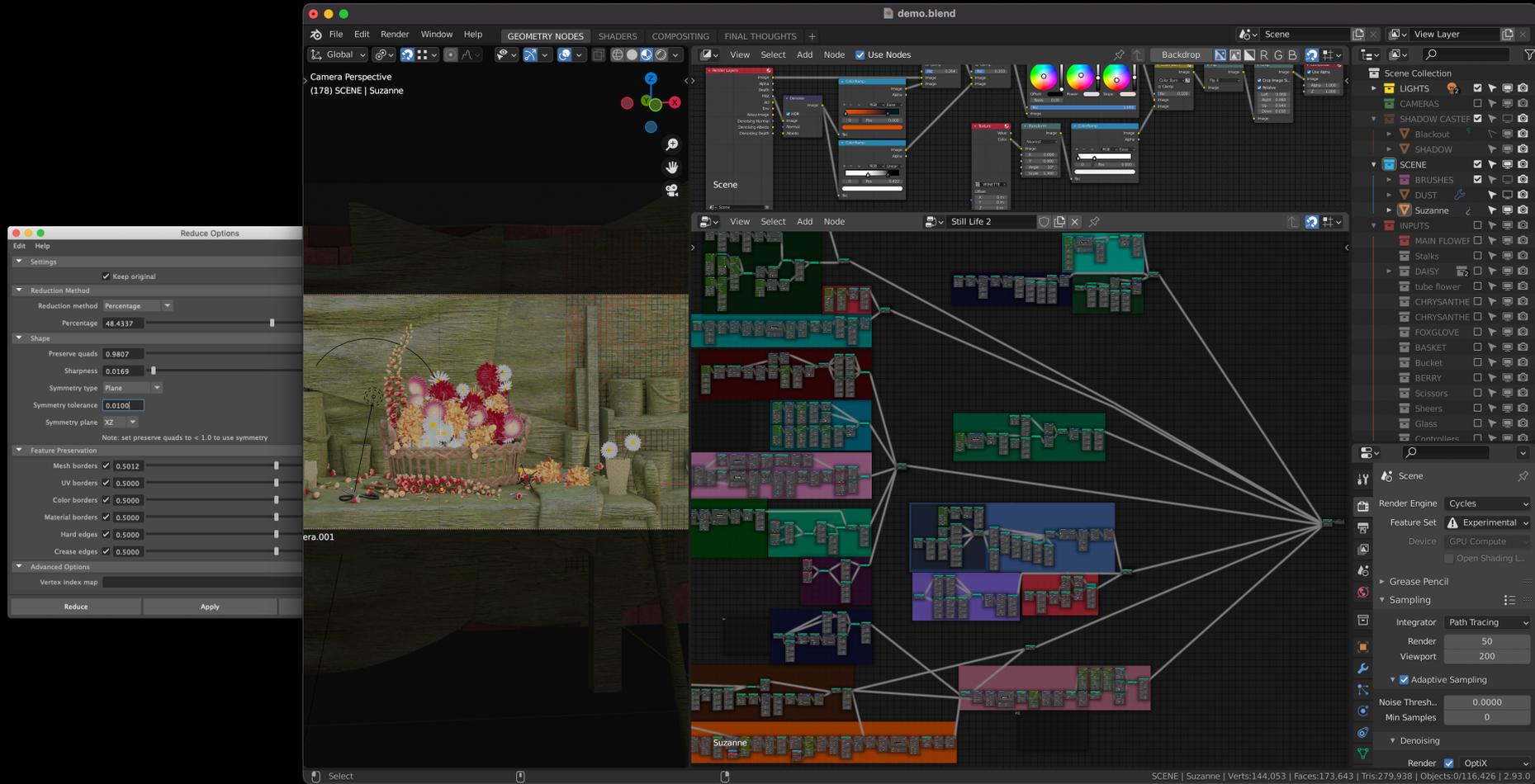






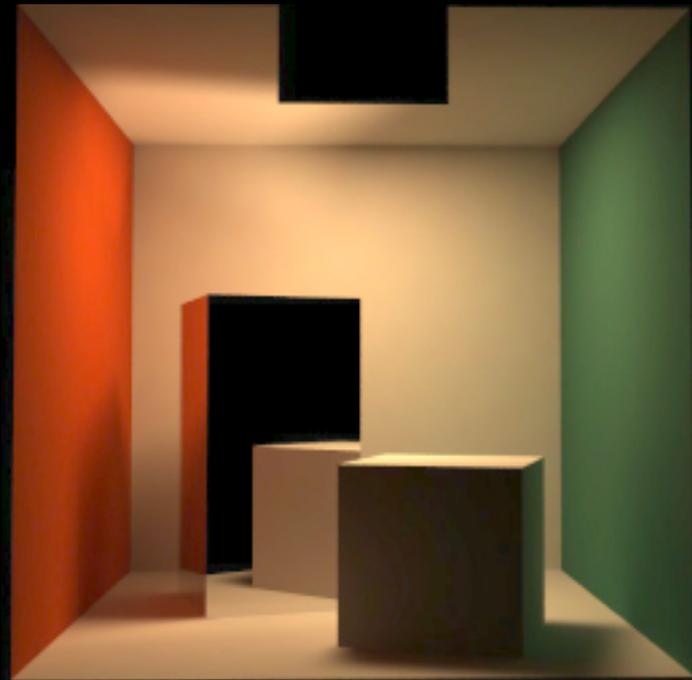
*Solves 75.59% cases*





*The Cornell Box Comparison* [Cindy et al 1984]

# *Which is the real?*

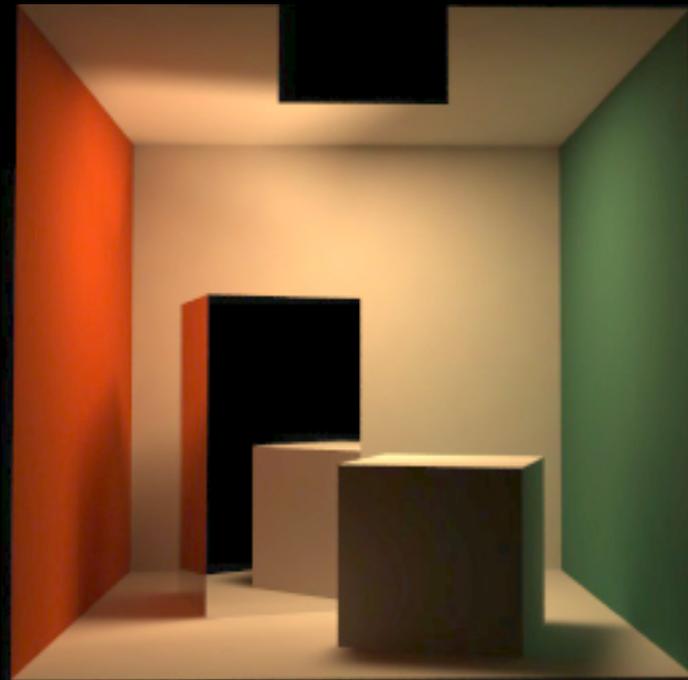


*The Cornell Box Comparison* [Cindy et al 1984]

# *Which is the real?*



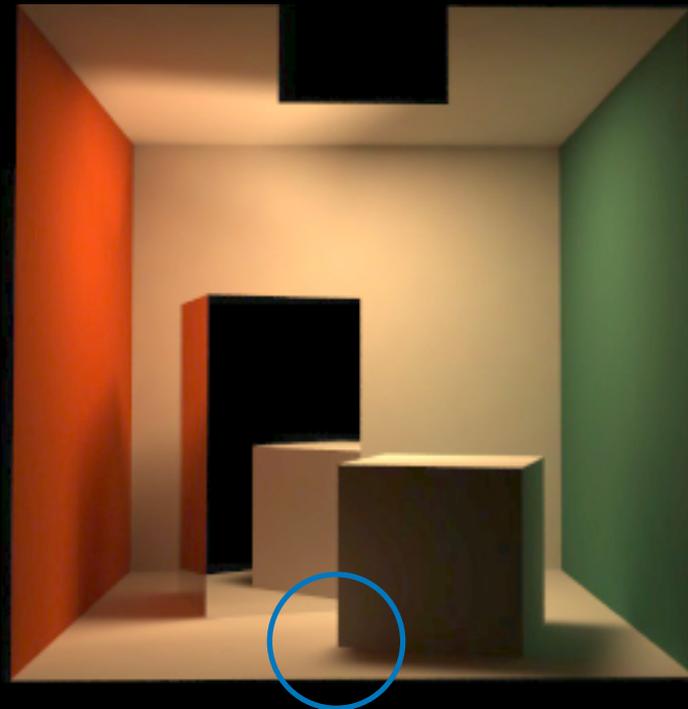
*Photo (Measured)*



*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.”*



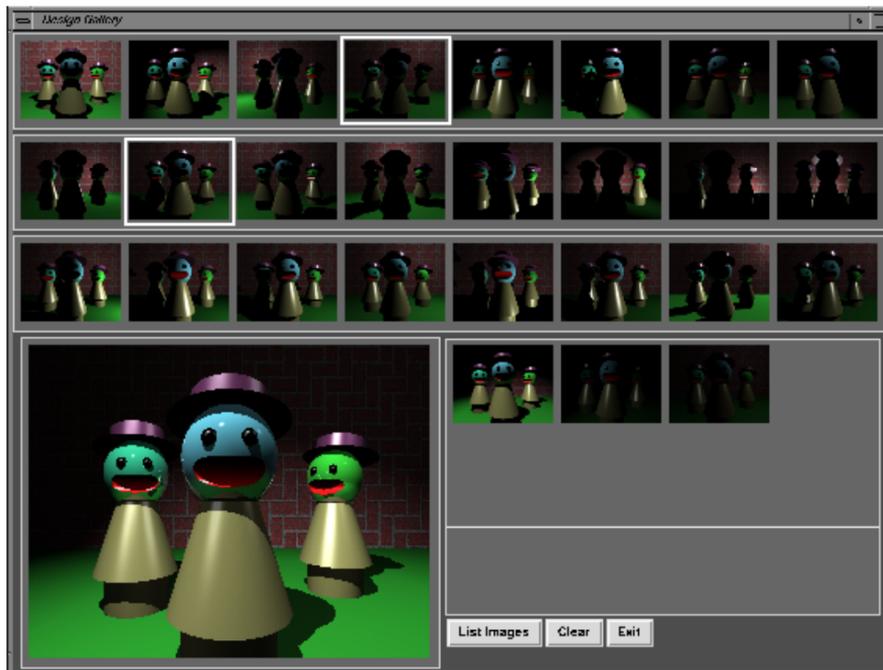
-20.0%



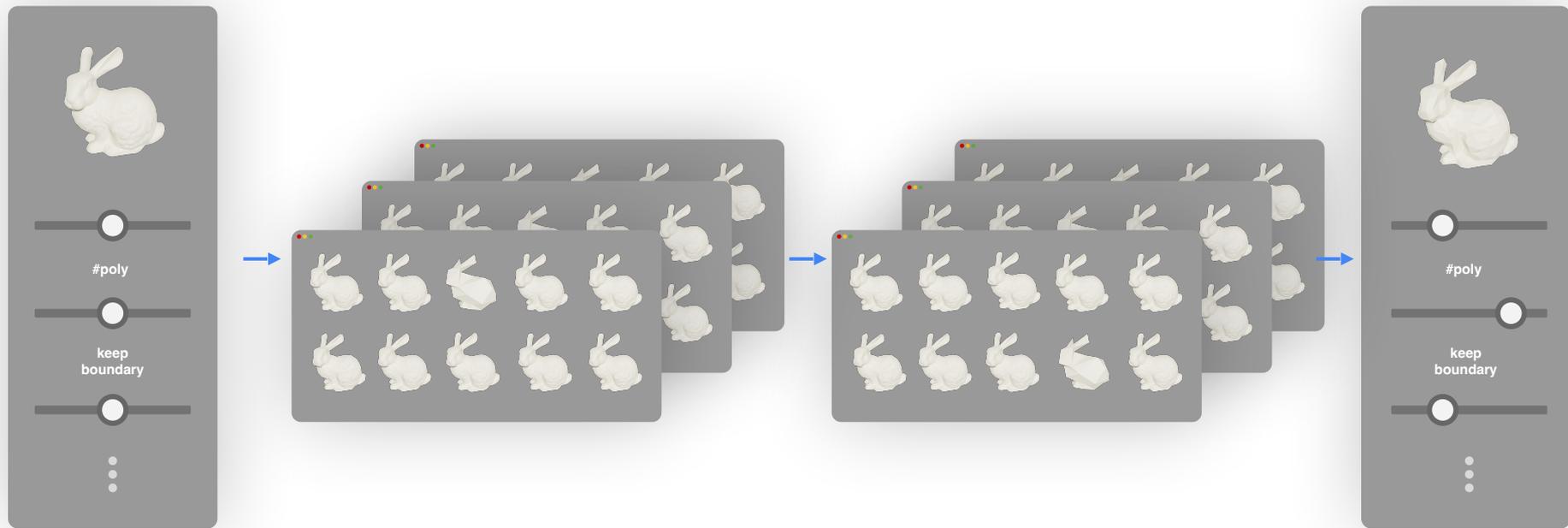
-89.4%

# 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:

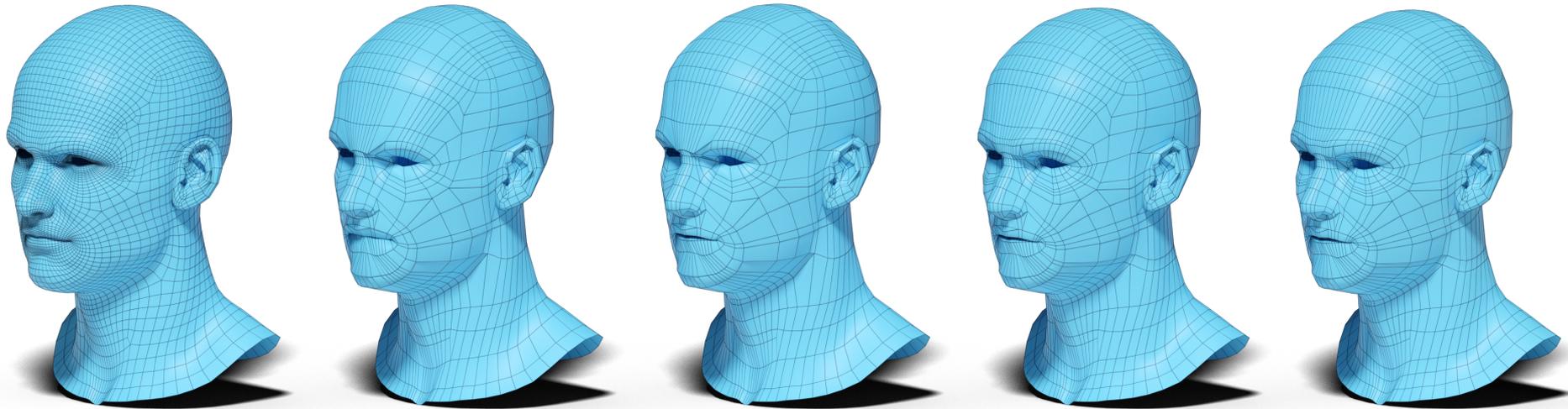
-89.4%



Done

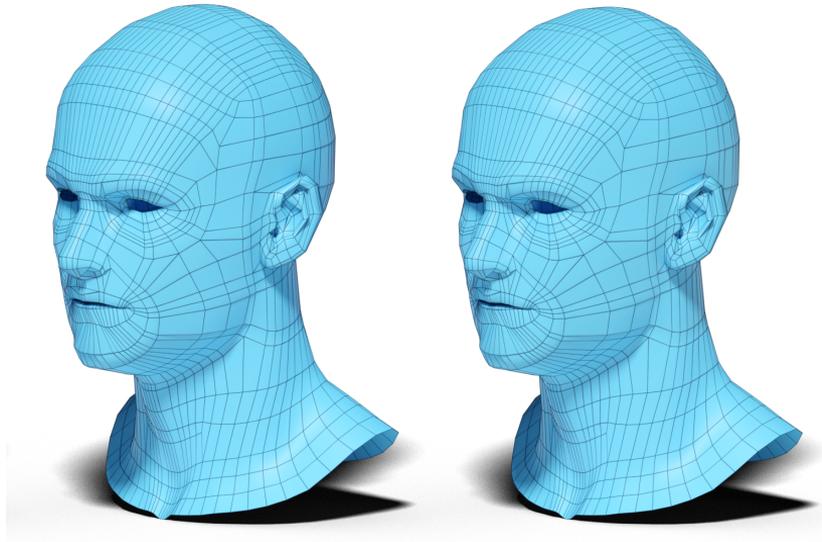
# How Good Is the Design? Will it Success at Scale?

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?*



Economic Choices<sup>†</sup>

By DANIEL McFADDEN\*

This Nobel lecture discusses the microeconomic analysis of choice behavior of consumers and developments in the economic theory of choice, and modifications to this theory that are being

THINKING,  
FAST AND SLOW



DANIEL  
KAHNEMAN

WINNER OF THE NOBEL PRIZE IN ECONOMICS

process from cognitive  
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developed as part of the  
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enterprise, and my  
reflects not only my  
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scholars! First, of  
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discrete choice anal-  
who played a major  
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nce, Amos Tversky,  
Ben-Akiva, Charles  
ain. A gallery of  
in Figure 1. I wish  
es, Marschak, and  
of their own chances

story  
ary postulates that  
e their self-interest,  
readily defined con-  
different decisions,  
usually antilogical,  
principles textbook

blue unless it has  
anything for an  
him satisfaction,  
ometimes foolish,  
in do, to please a  
fast they think at

my contributions to eco-  
z, John Chipman, Marc  
attracted me to the field  
"

# Rating Distribution

4, 2, 1, 1       $(\mu_1, \sigma_1)$



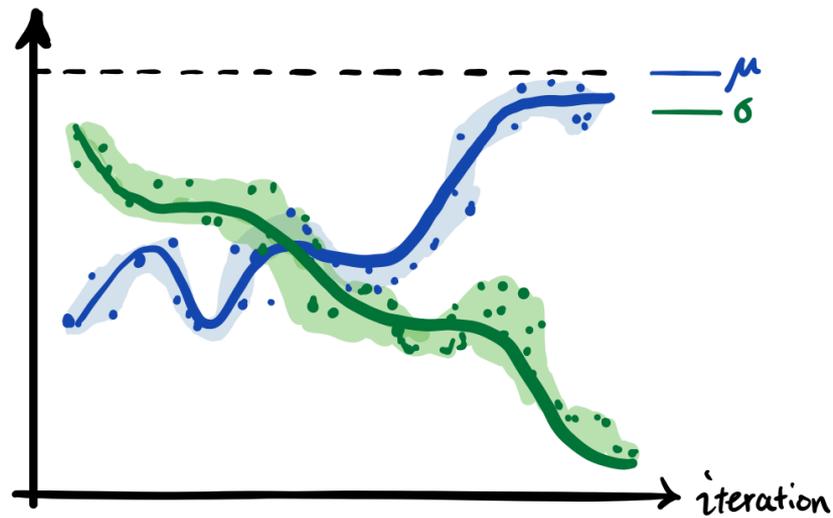
3, 4, 1, 2       $(\mu_2, \sigma_2)$



5, 4, 2, 3       $(\mu_3, \sigma_3)$



...



# Rating Distribution

4, 2, 1, 1       $(\mu_1, \sigma_1)$



3, 4, 1, 2       $(\mu_2, \sigma_2)$

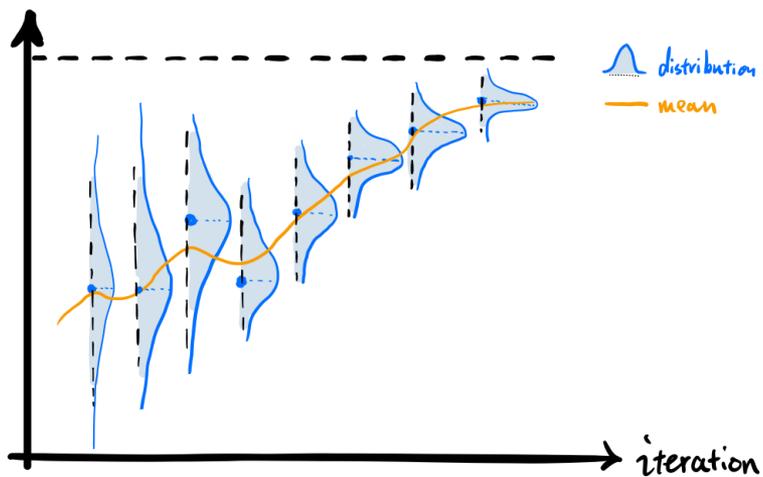


5, 4, 2, 3       $(\mu_3, \sigma_3)$



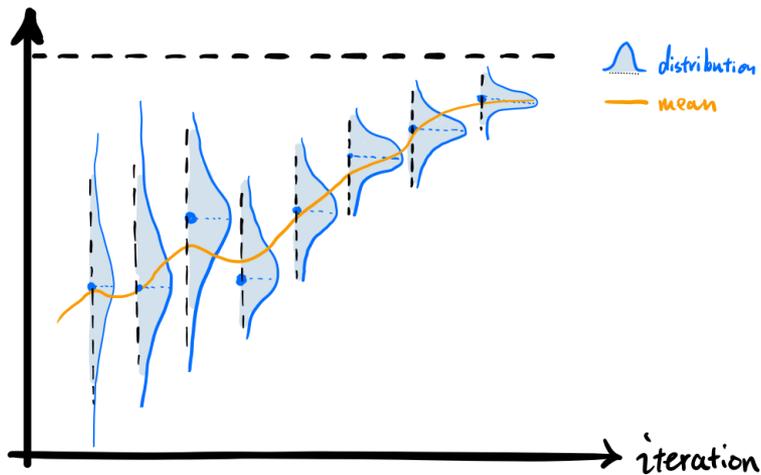
...

# Expectation vs. Reality

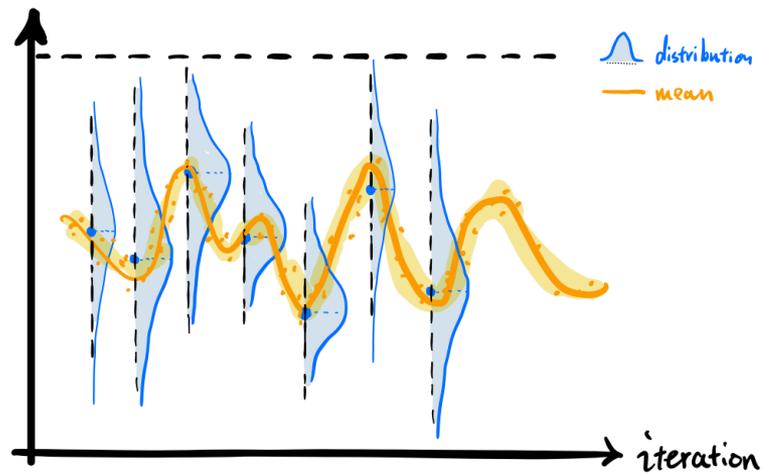


Expected Behavior

# Expectation v.s. Reality



Expected Behavior



Actual Behavior



Base



5

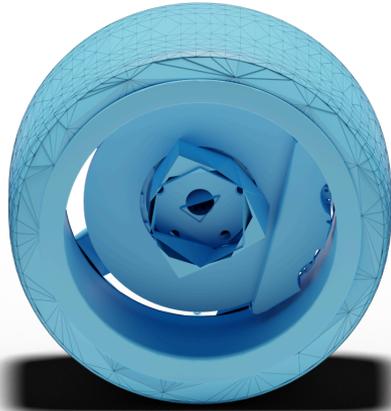




Base



5



- Human judgements are
  - Erratical, 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?

▼ Encoding ⋮

Container Matroska ▼

Autosplit Output

▼ Video

Video Codec H.264 ▼

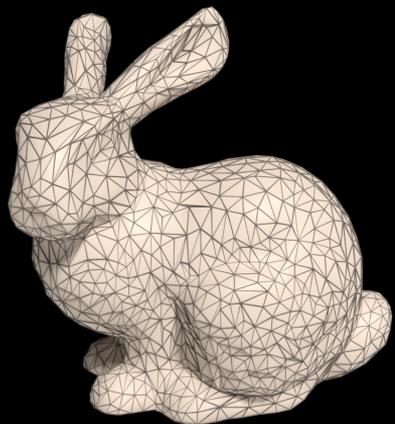
Output Quality Perceptually Lossless ▼

Encoding Speed Good ▼

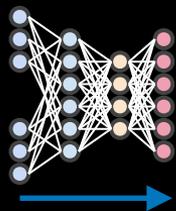
Keyframe Interval 18

Max B-frames  0

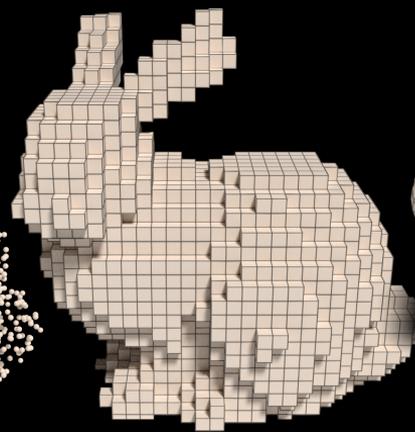
← **Peak Signal to Noise Ratio (PSNR)**  
**Structure Similarity (SSIM)**



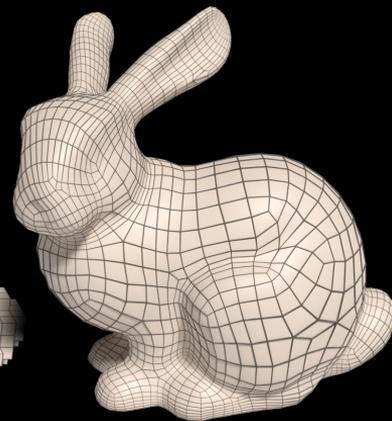
Original



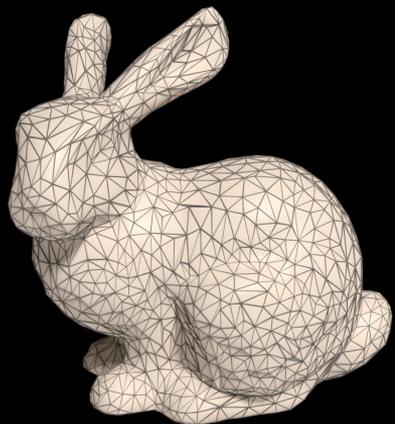
Point



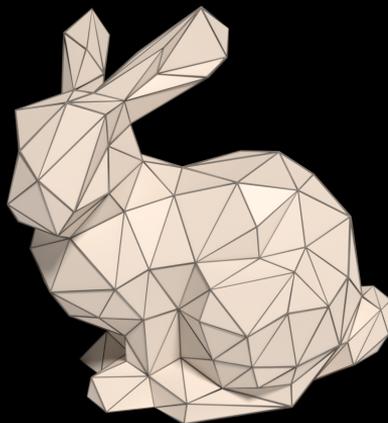
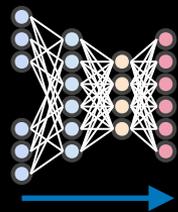
Voxel



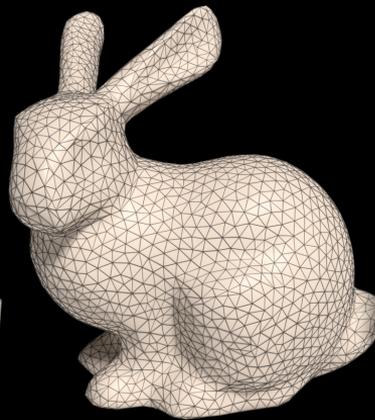
Mesh



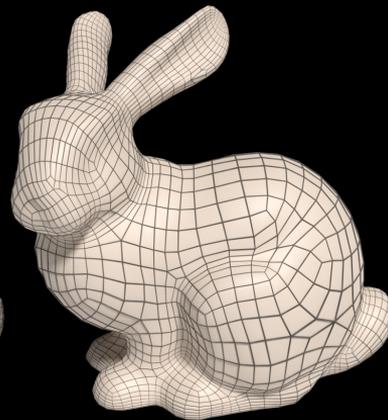
Original



Reduced



Resampled



Remeshed

# The Objective



# The Objective



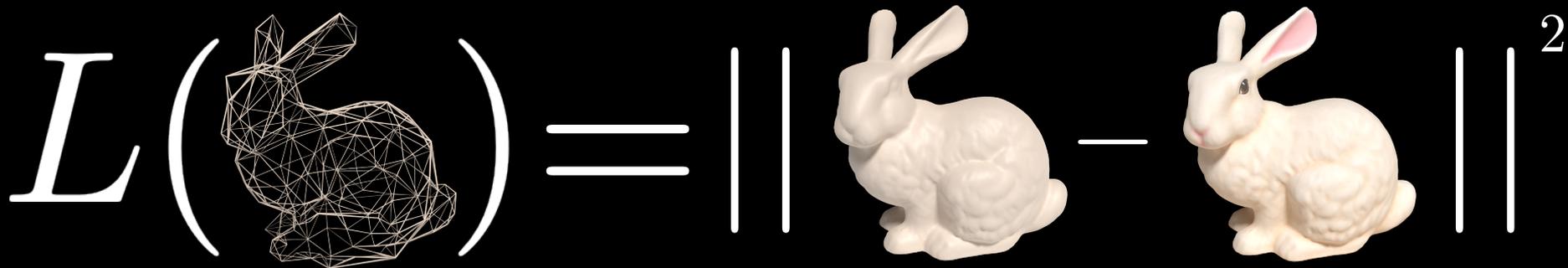
# The Objective



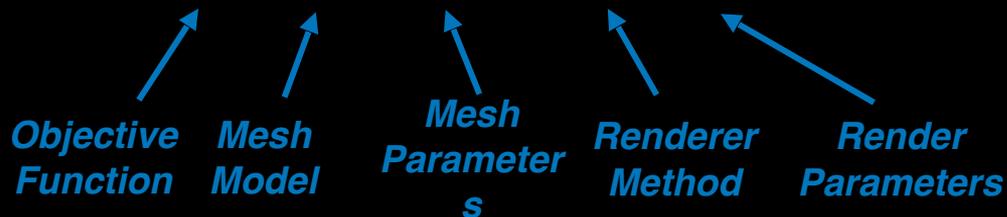
# The Objective

$$L(\text{wireframe rabbit}) = || \text{smooth rabbit} - \text{textured rabbit} ||^2$$

# The Objective

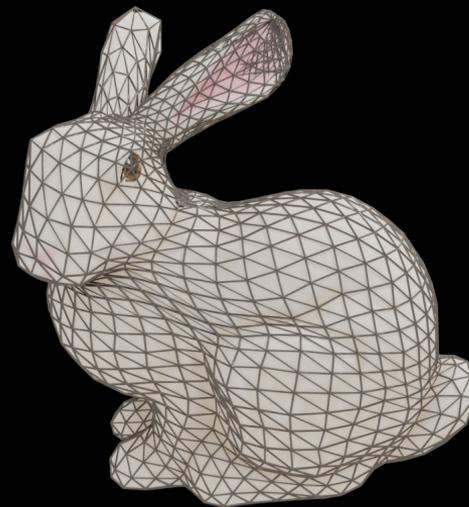
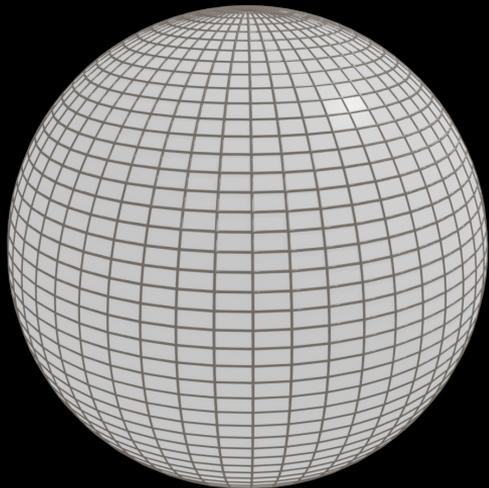


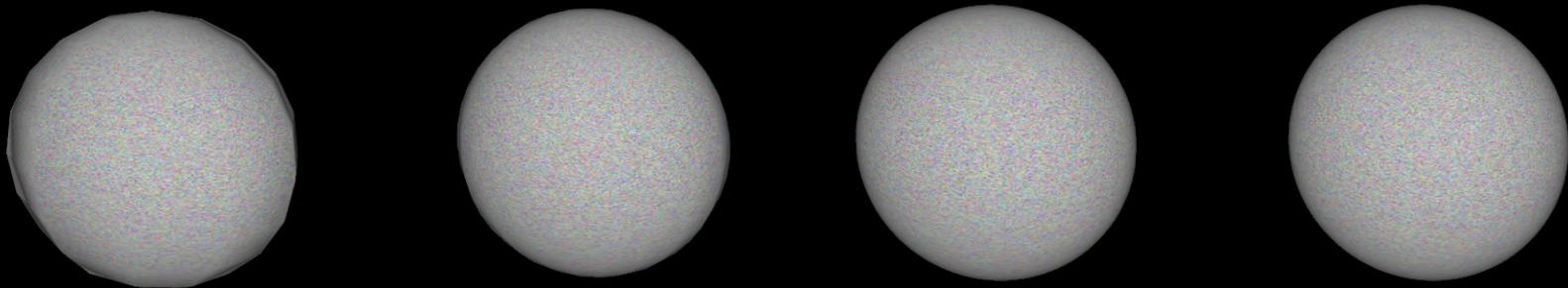
$$\text{minimize } L(M(\mathbf{p}_1), r(\mathbf{p}_2))$$



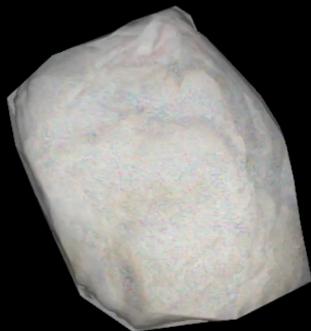
# Q: Where should we start?

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# Image-driven



180 faces



760 faces

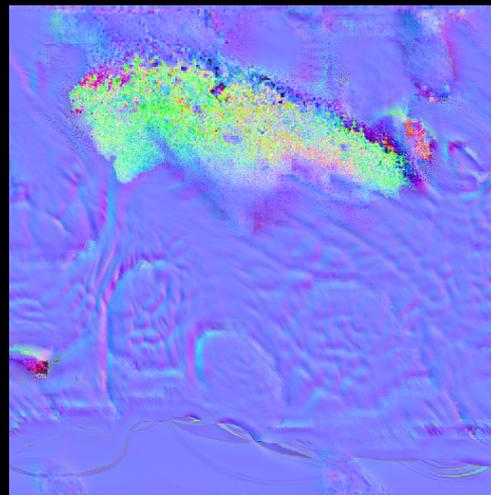
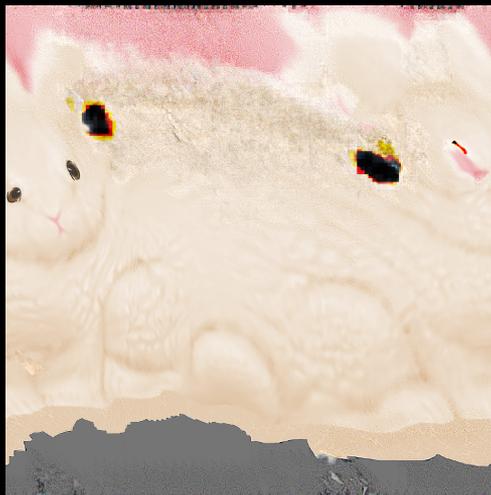
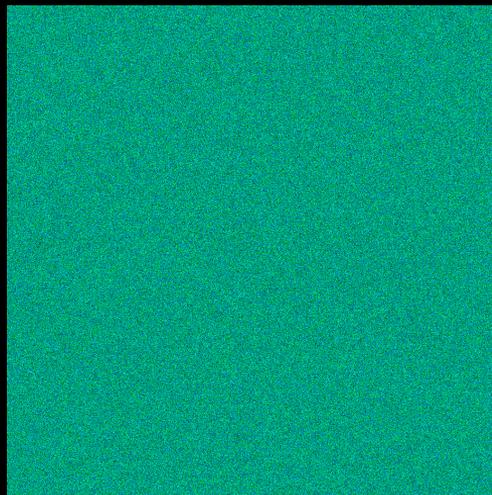


4900 faces

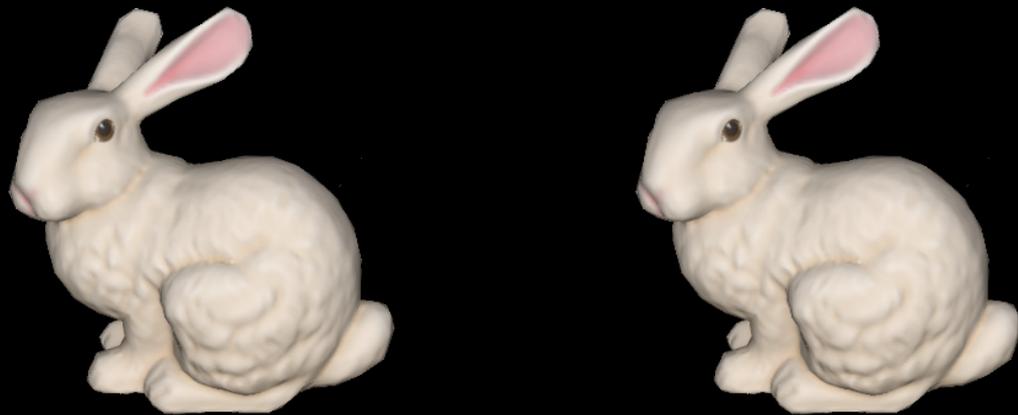


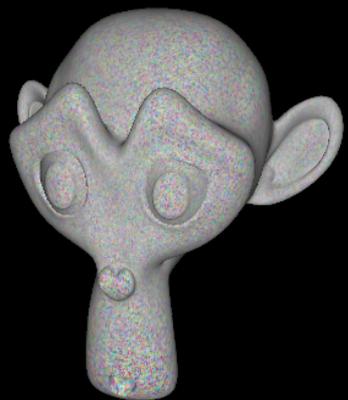
12640 faces

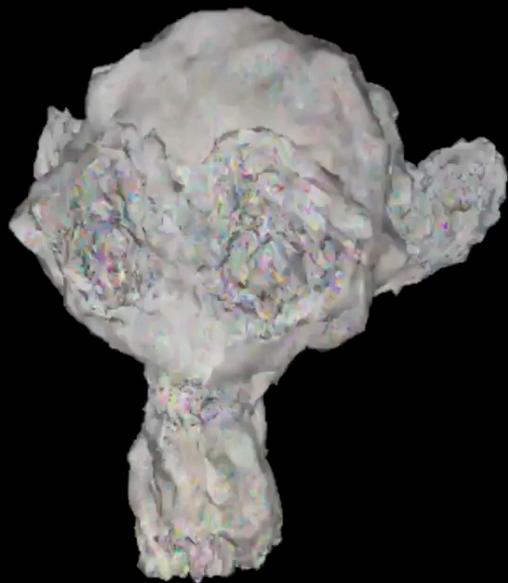
# Learned Texture Maps

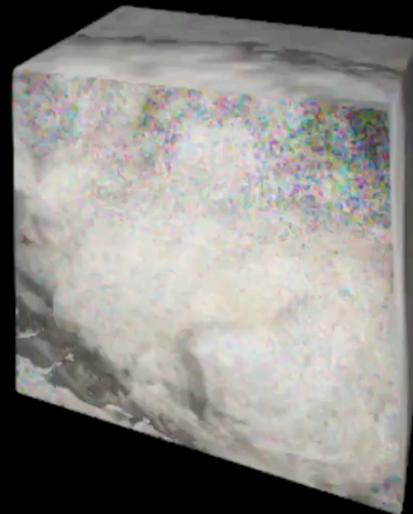
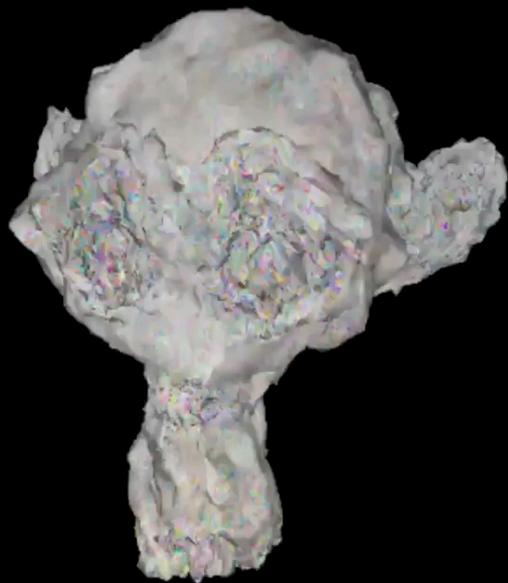


# Q: Which is the original mesh?





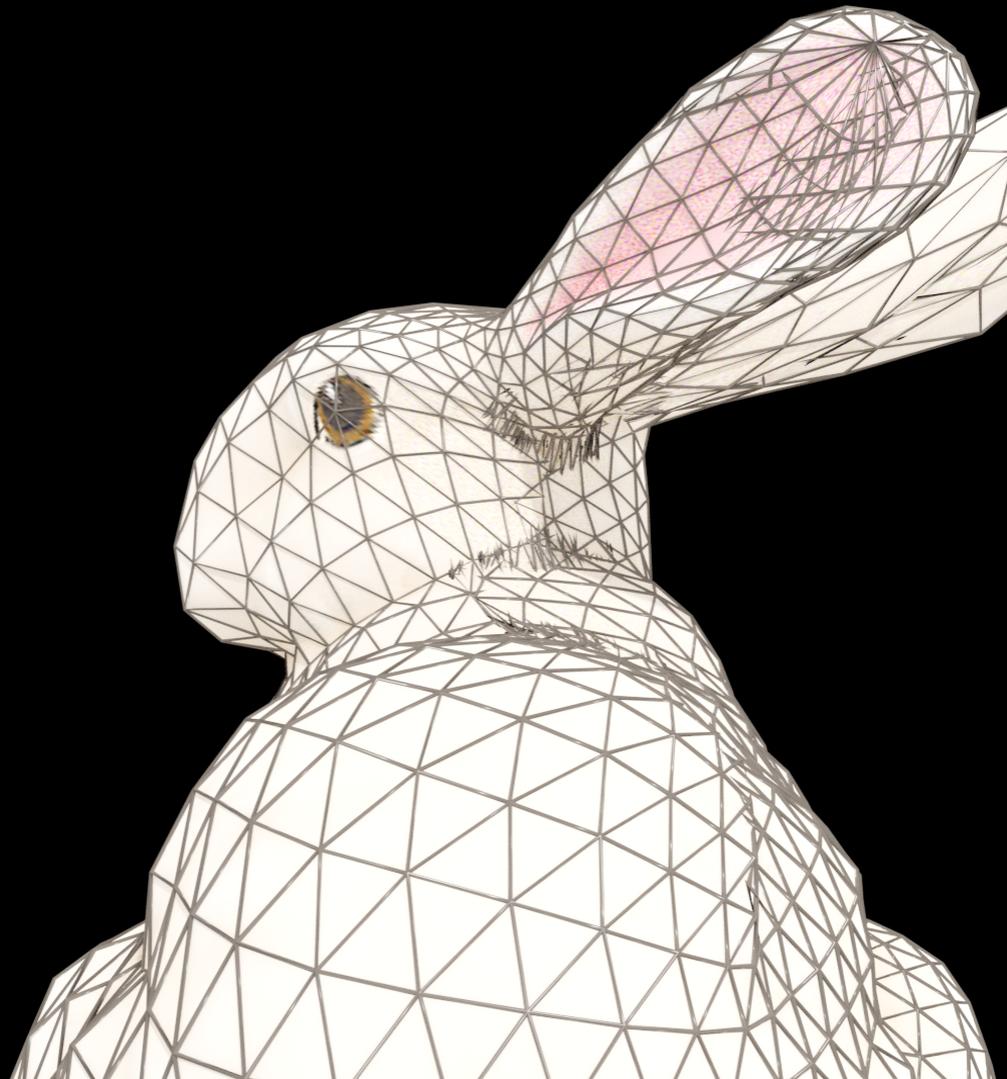






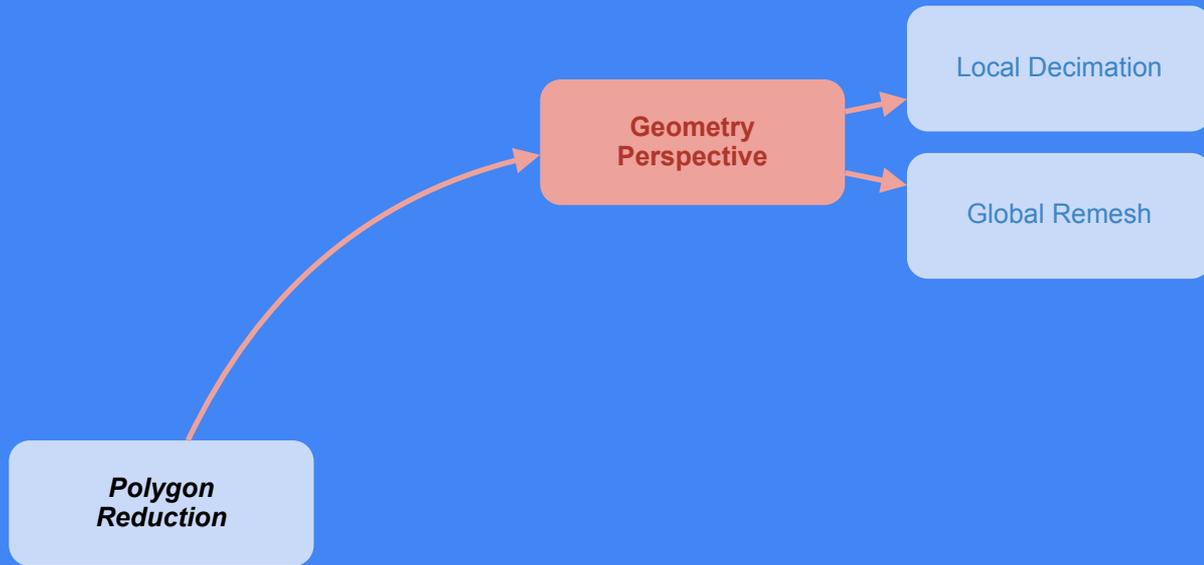
## Issues:

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.

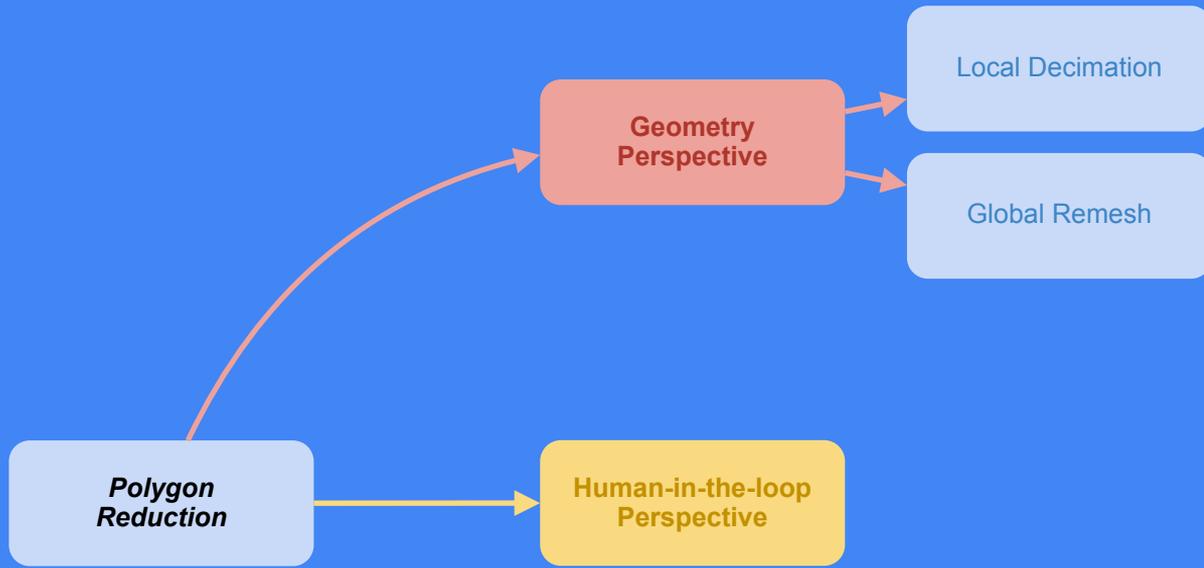


# Summary

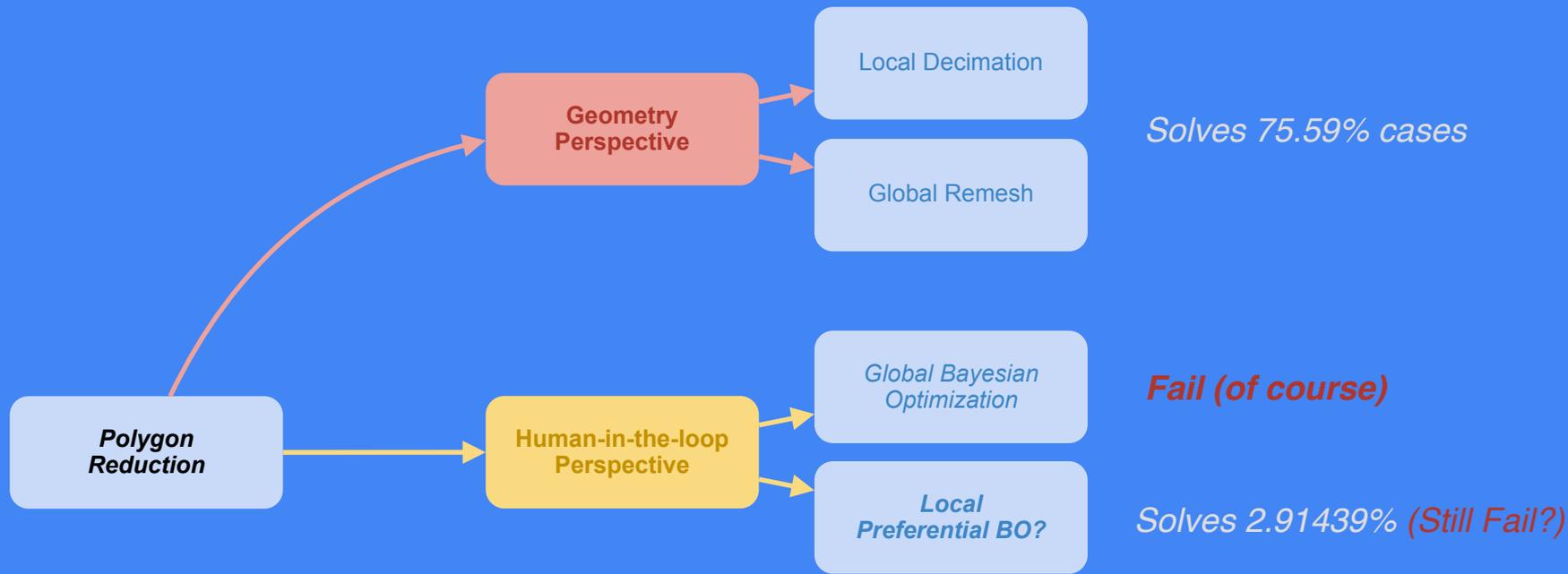


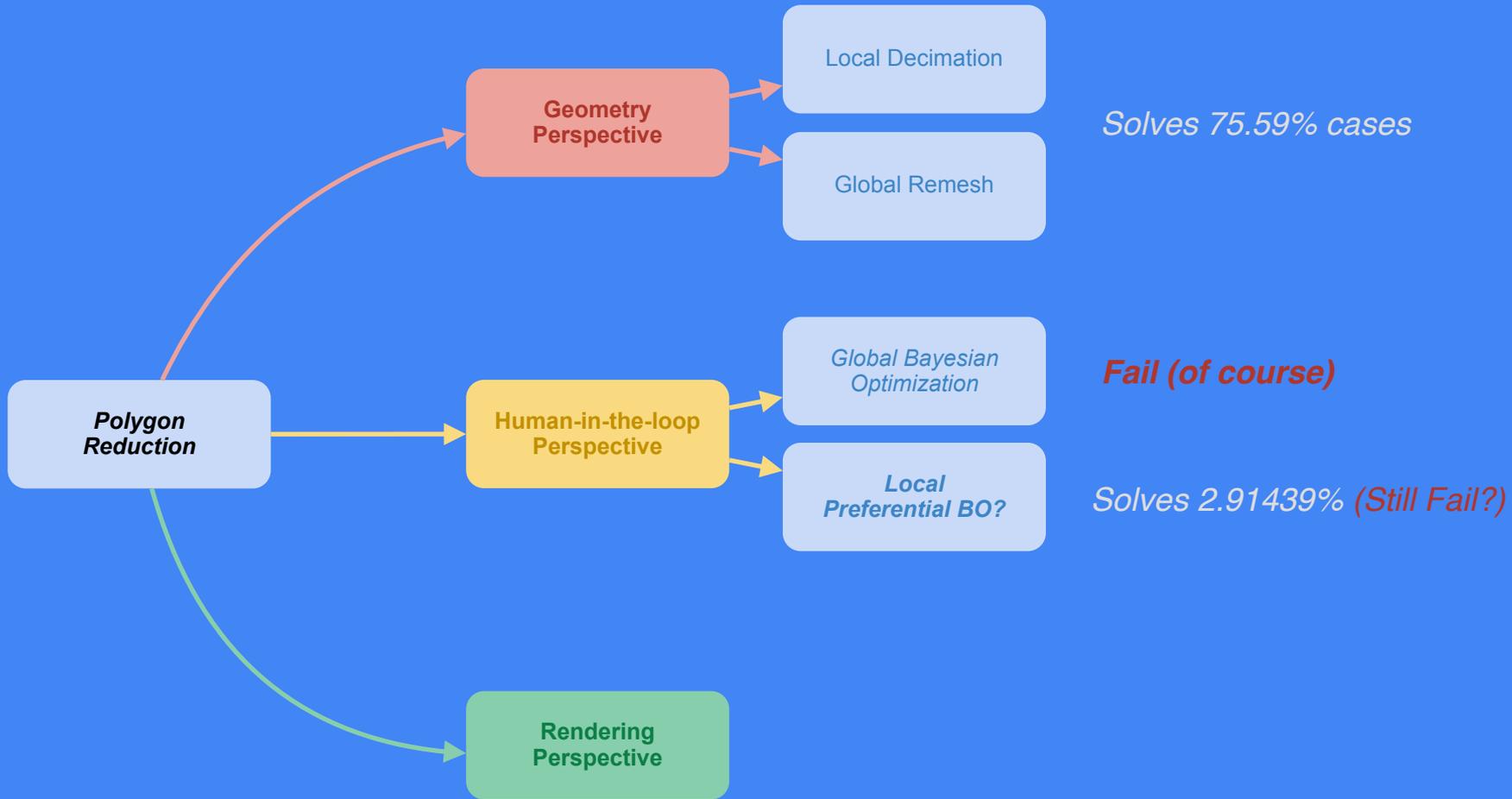


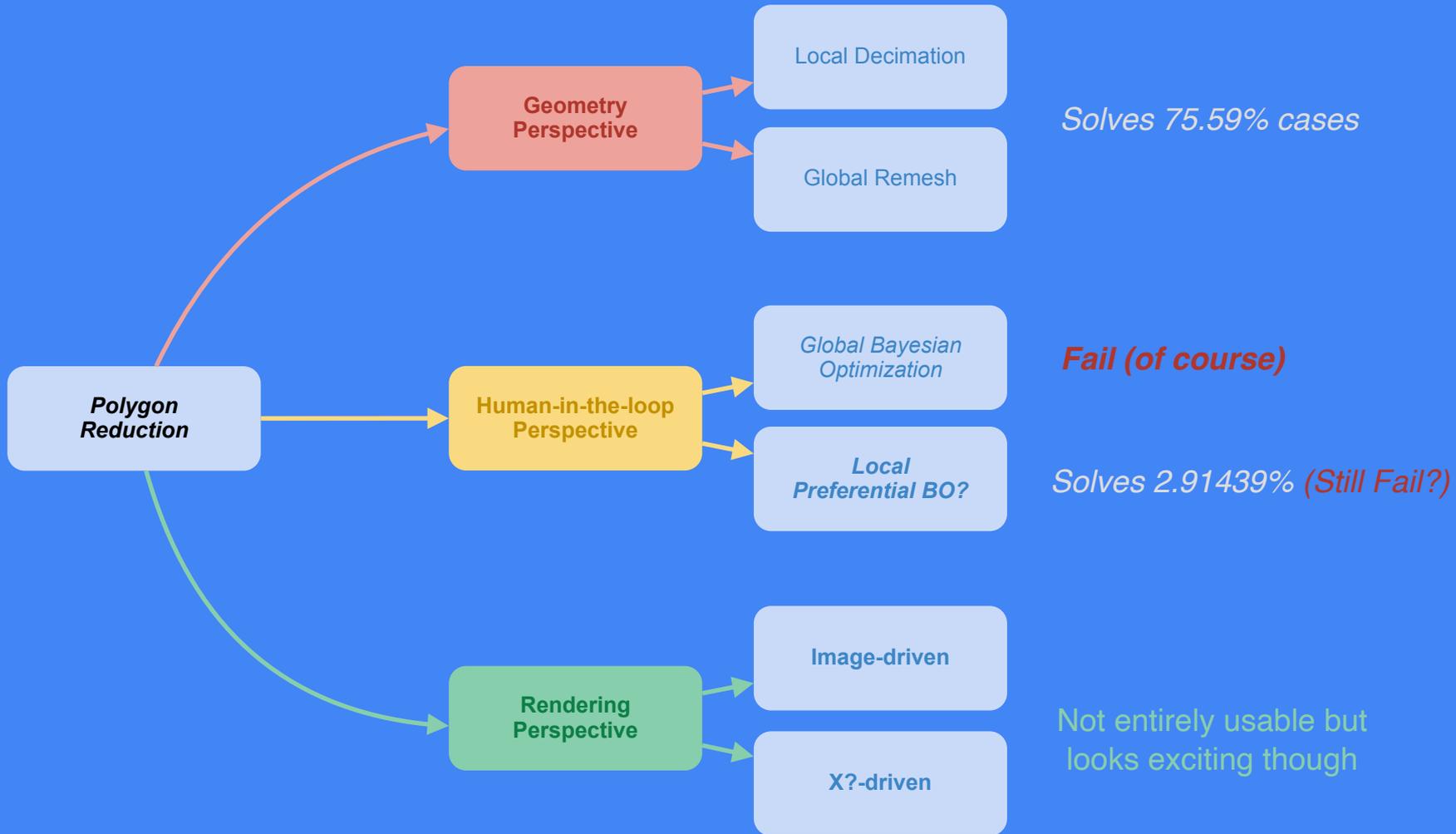
*Solves 75.59% cases*



*Solves 75.59% cases*

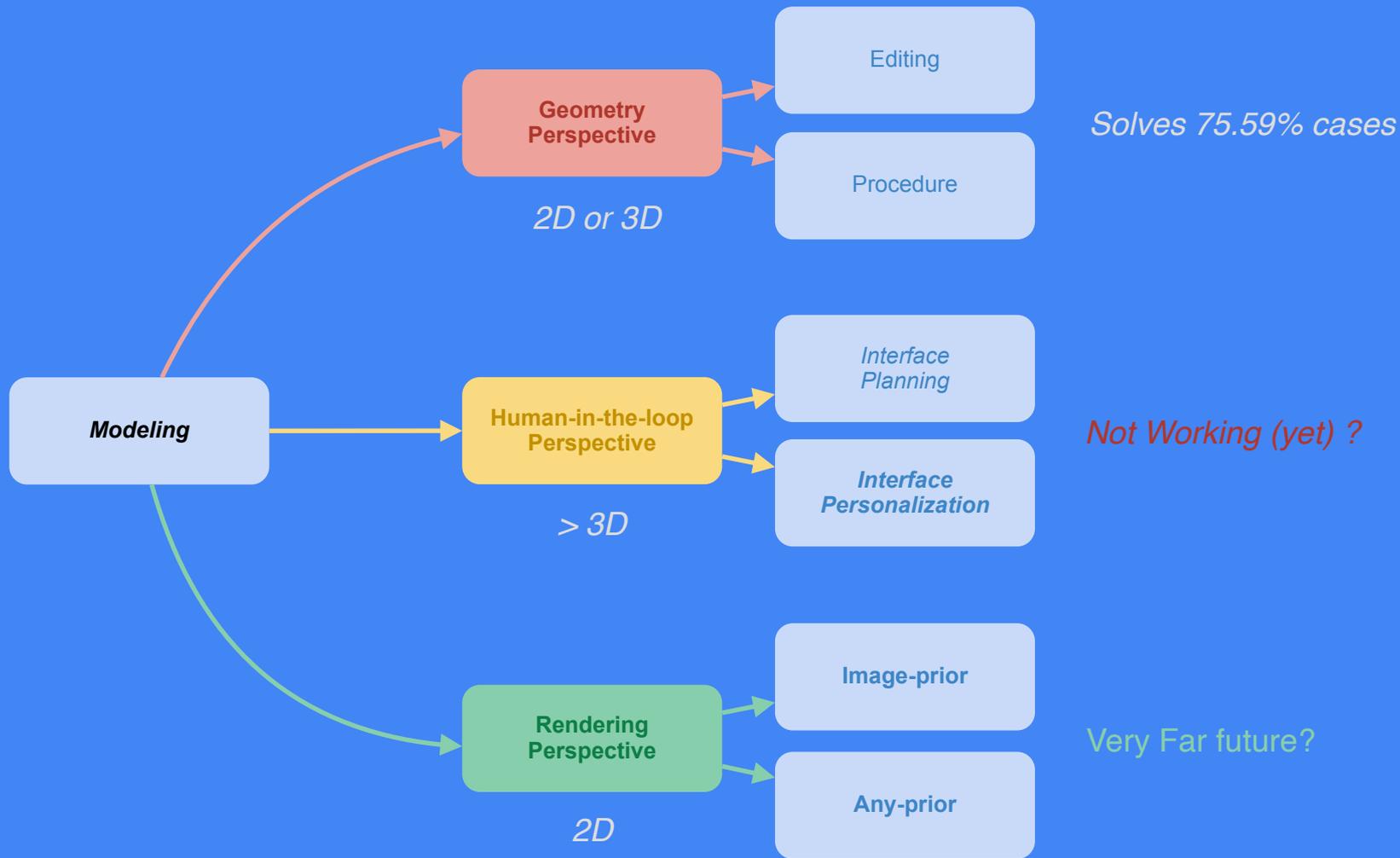






# Bigger Picture





- 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?