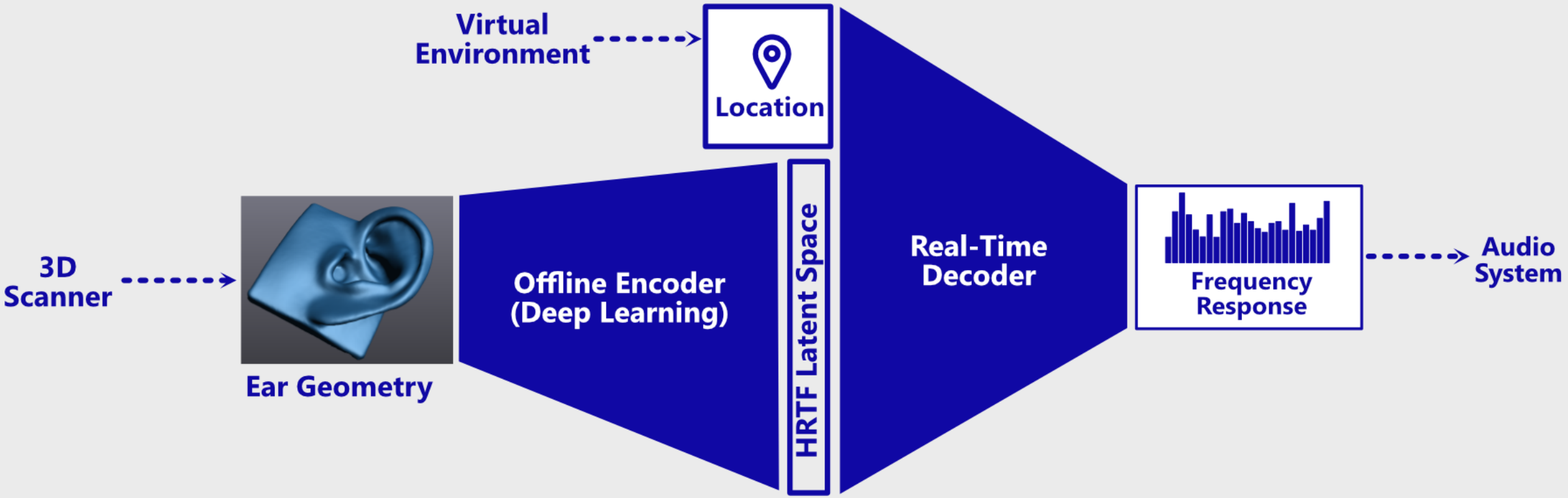
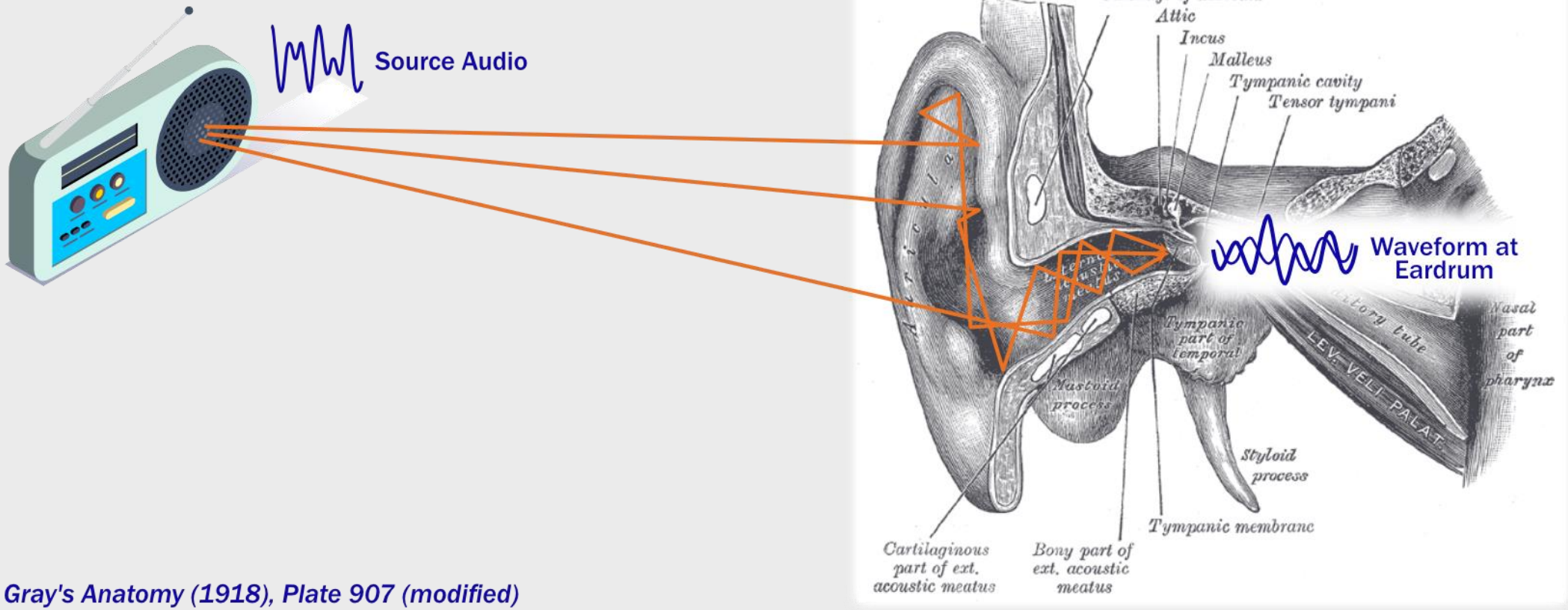
RAISE Center of Excellence

T4.4 Sound Engineering

Eric Michael Sumner, University of Iceland

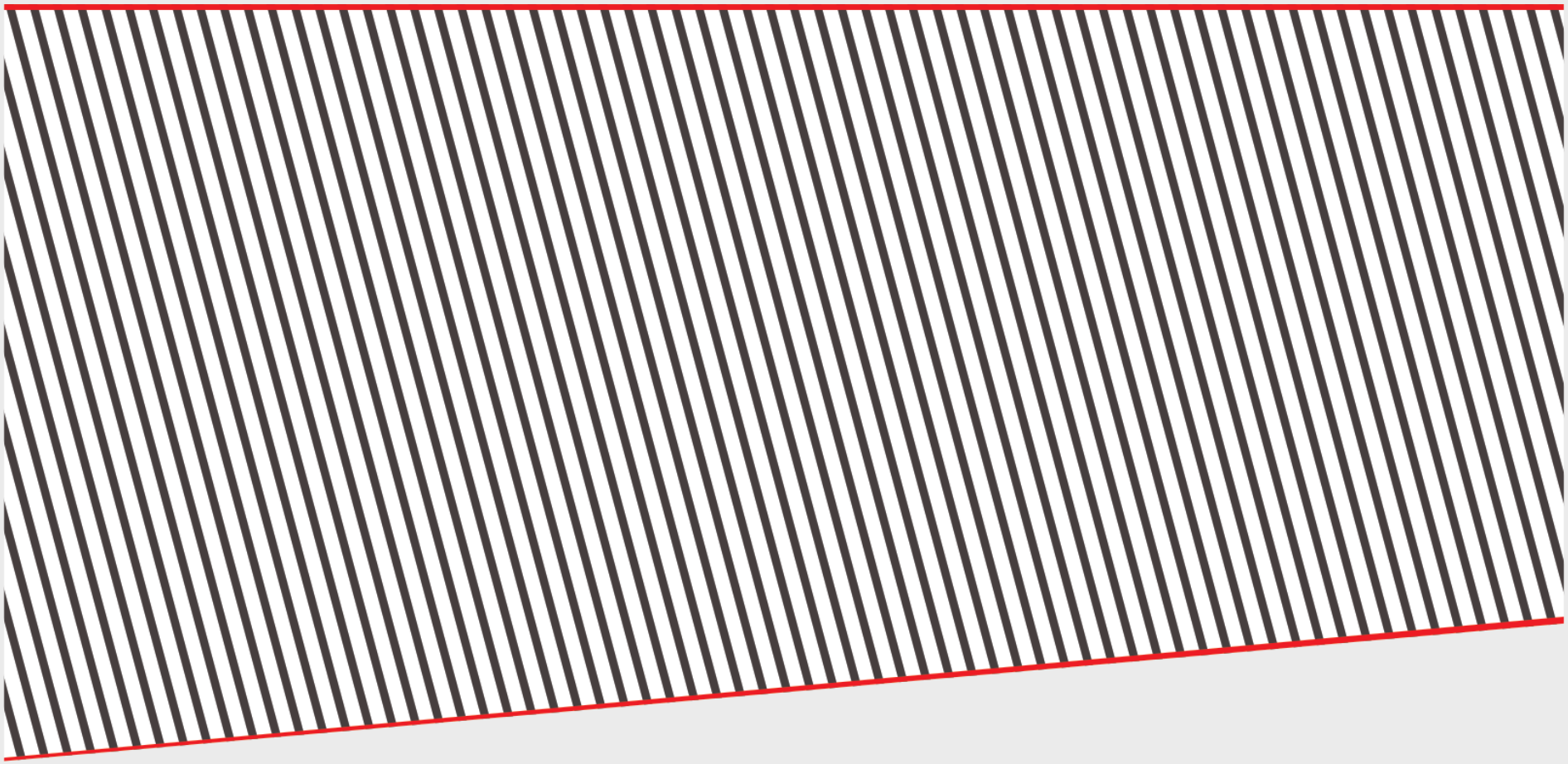

Virtual Environment
Location
3D Scanner
Ear Geometry
Offline Encoder (Deep Learning)
HRTF Latent Space
Real-Time Decoder
Frequency Response
Audio System



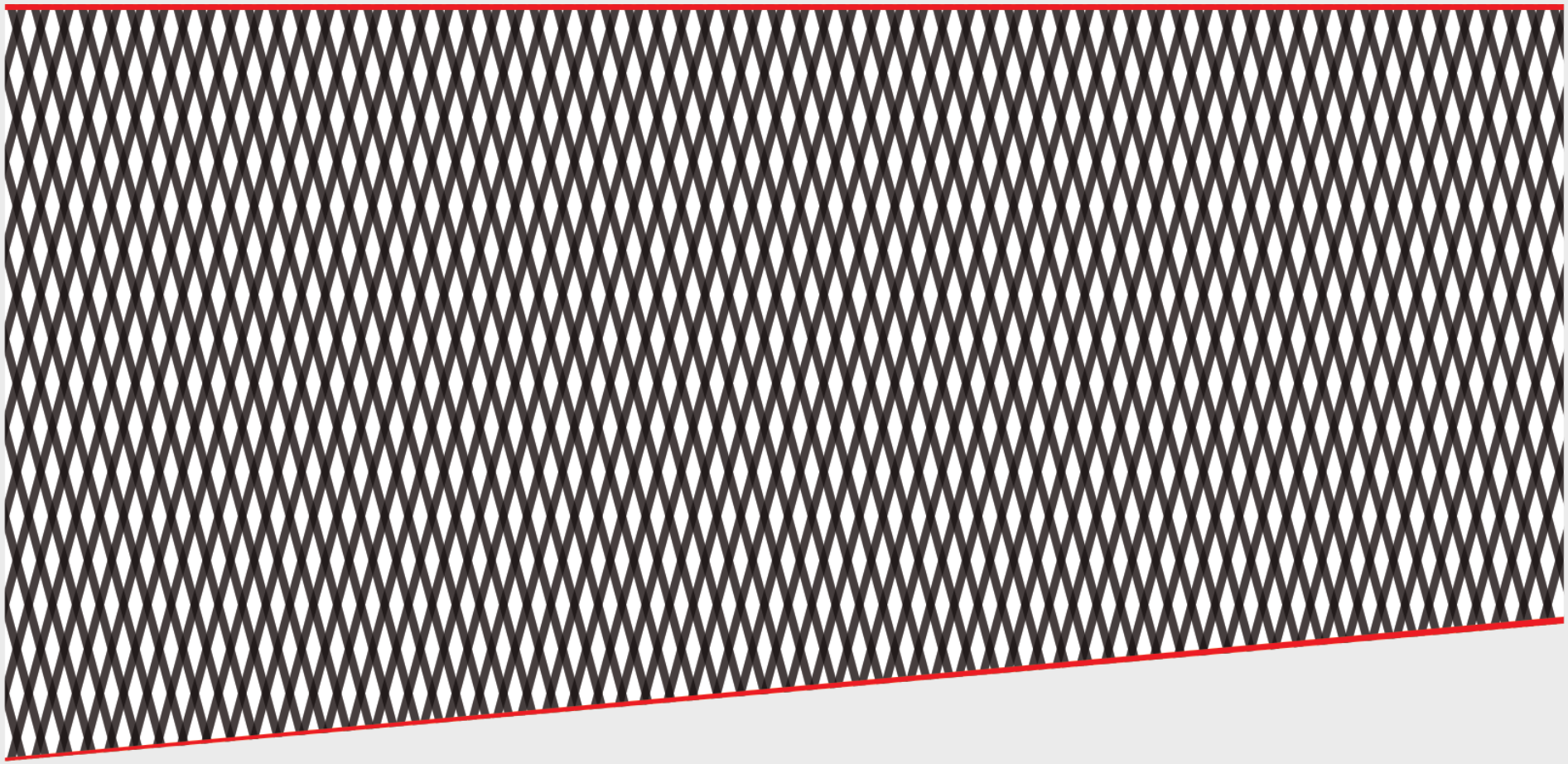
Gray's Anatomy (1918), Plate 907 (modified)

Mechanism of Action

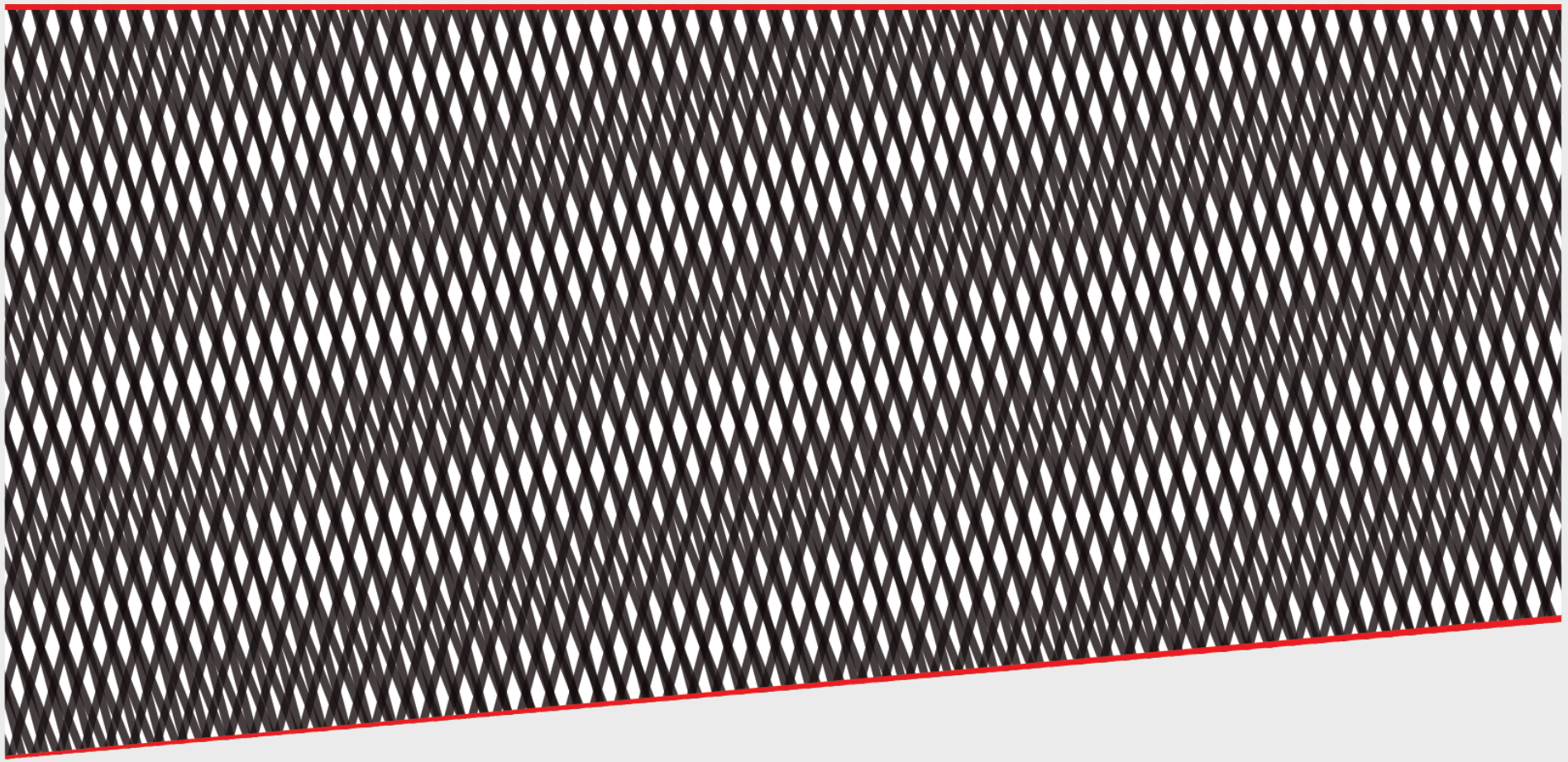
Mechanism of Action



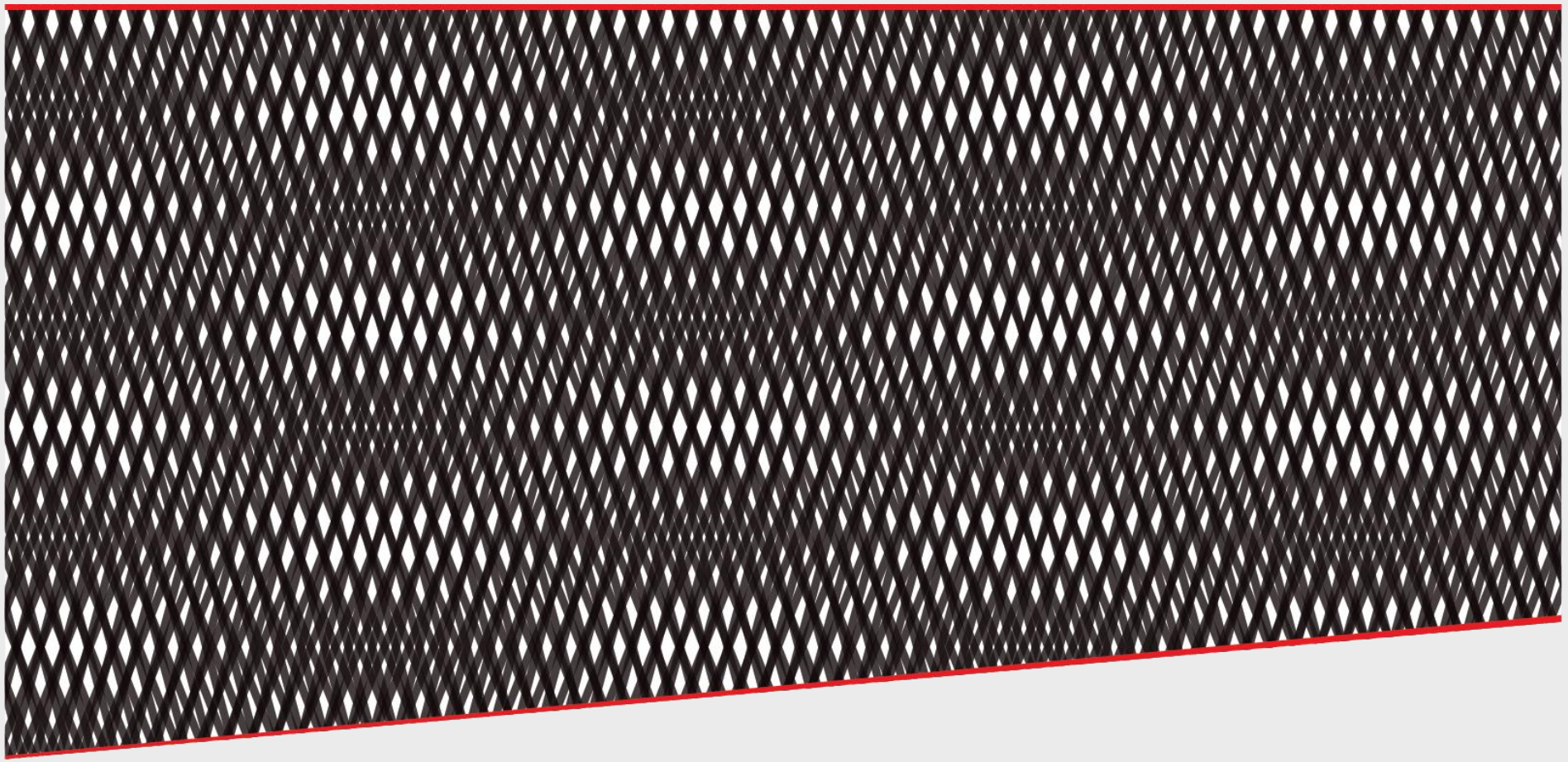
Mechanism of Action



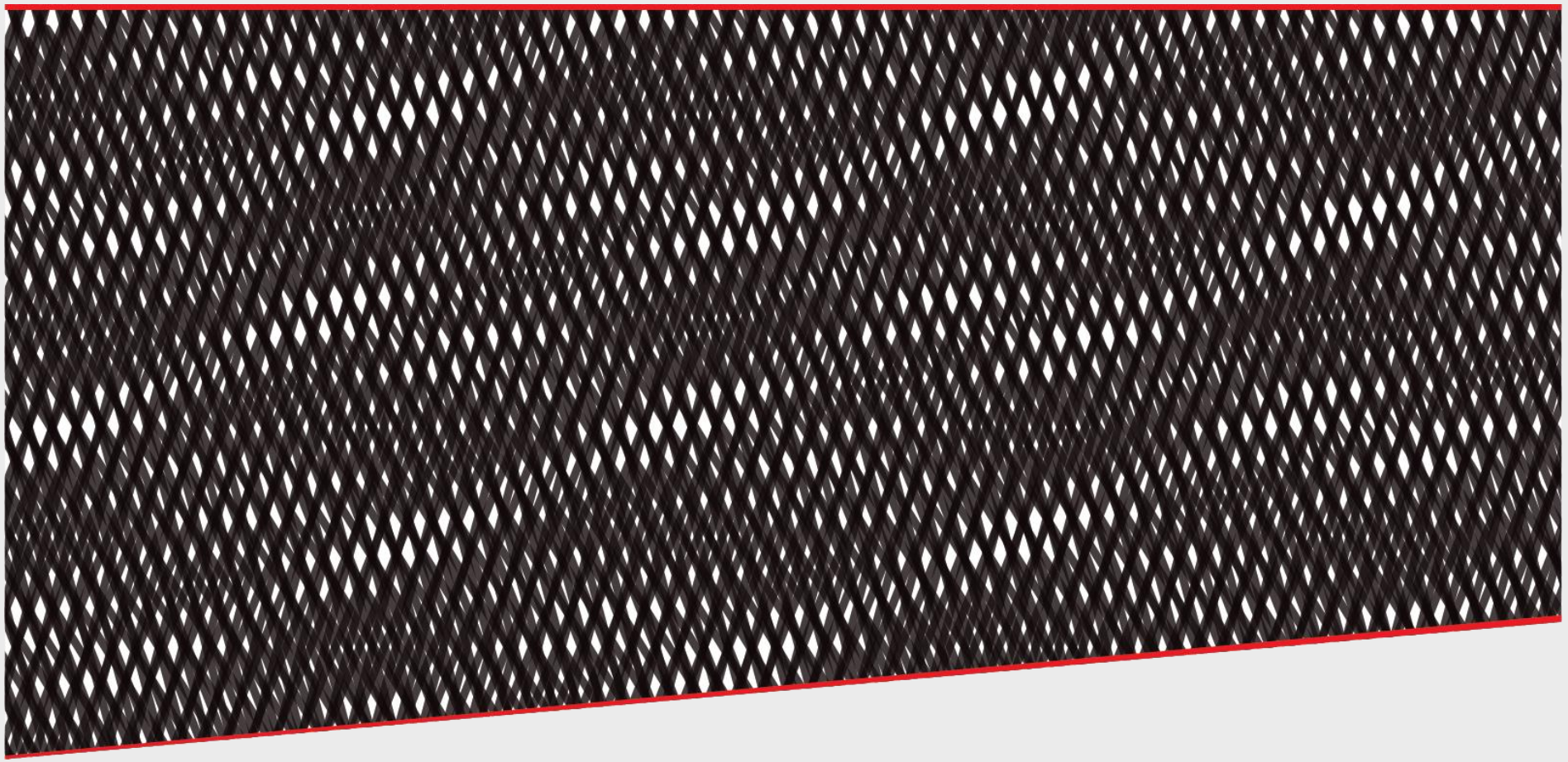
Mechanism of Action



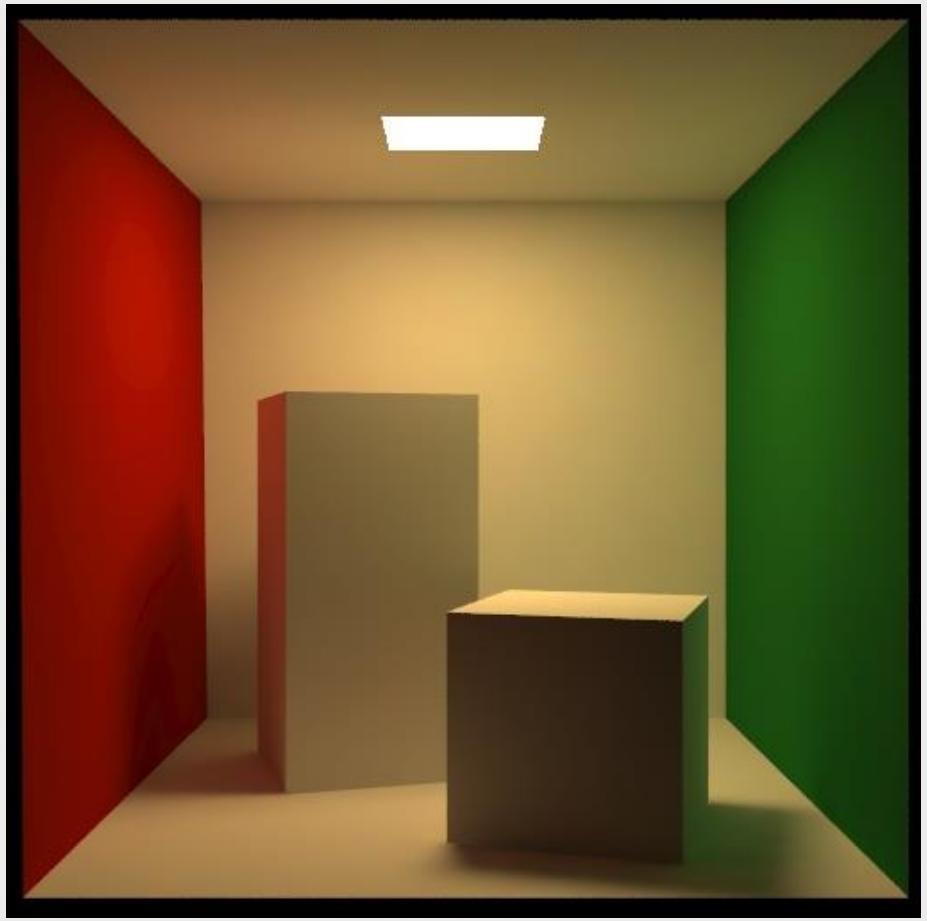
Mechanism of Action



Mechanism of Action



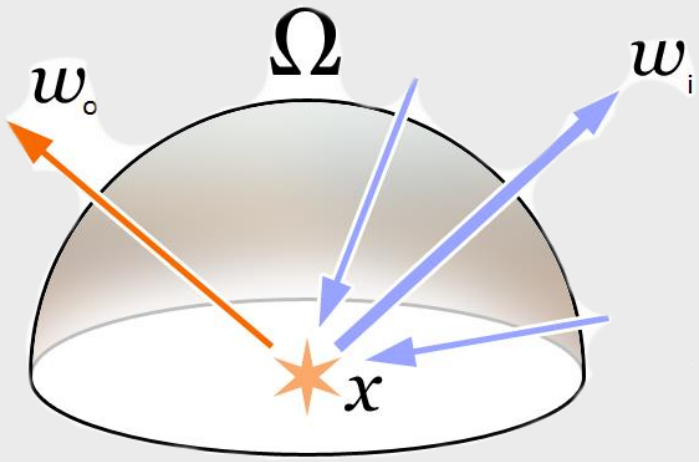
Related Problem: Radiosity



http://www.graphics.cornell.edu/online/box/

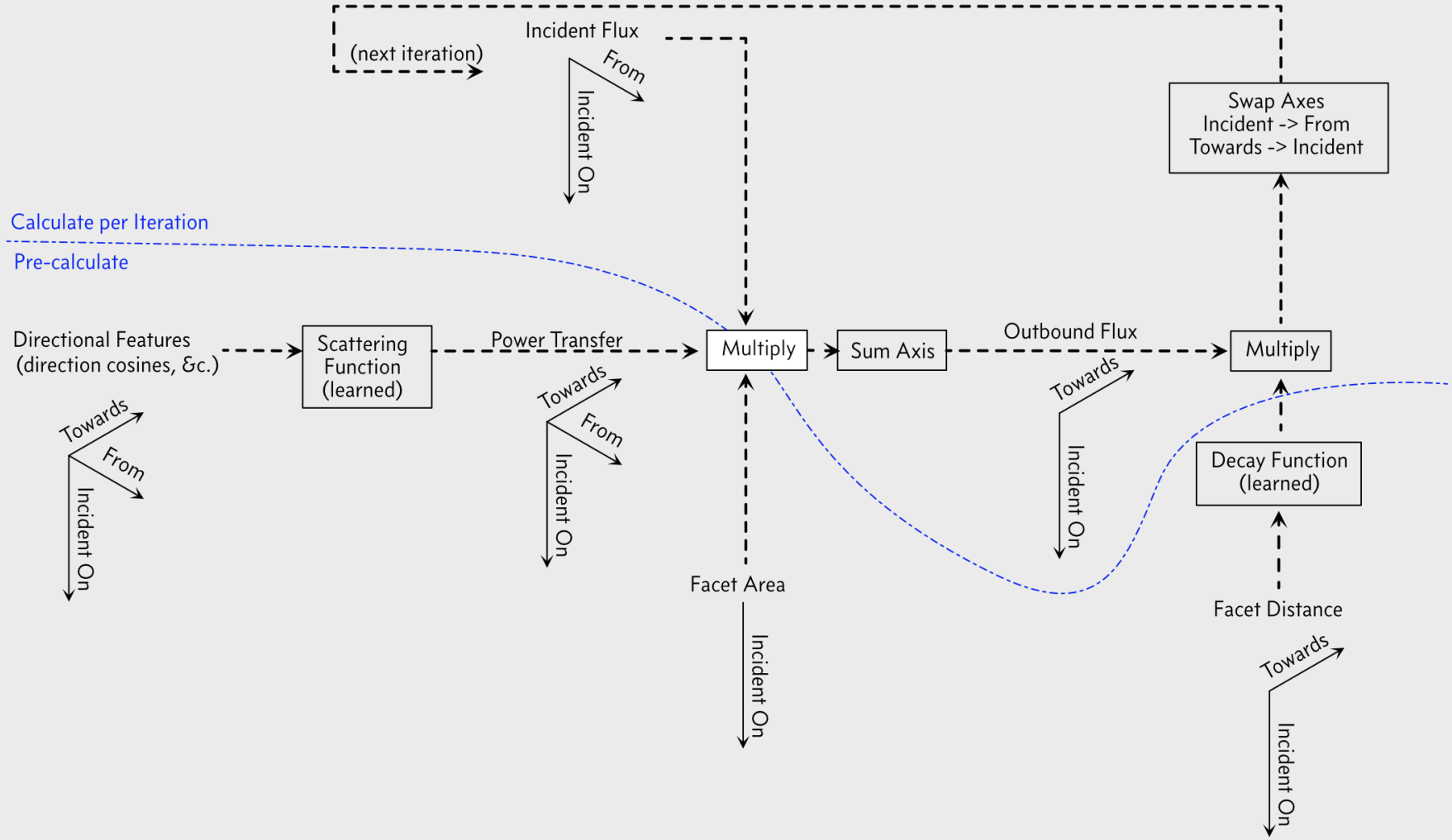
Rendering Equation

$$L_{\mathrm{r}}(\mathbf{x}, \omega_{\mathrm{o}}, \lambda, t) = \int_{\Omega} f_{\mathrm{r}}(\mathbf{x}, \omega_{\mathrm{i}}, \omega_{\mathrm{o}}, \lambda, t) L_{\mathrm{i}}(\mathbf{x}, \omega_{\mathrm{i}}, \lambda, t)(\omega_{\mathrm{i}} \cdot \mathbf{n}) \, \mathrm{d}\, \omega_{\mathrm{i}}$$



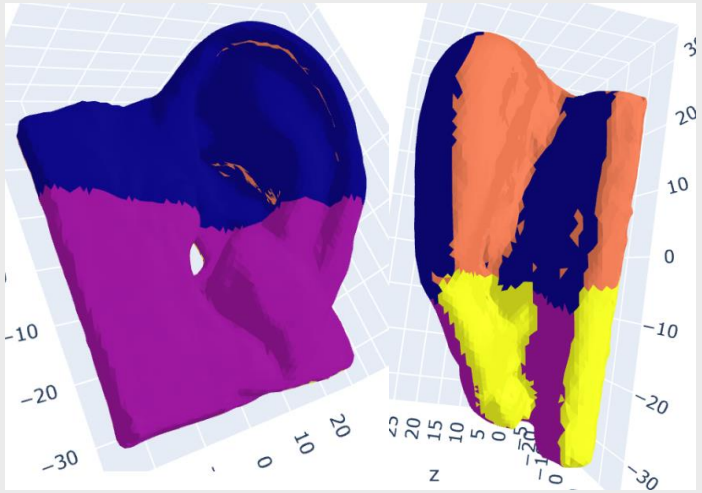
https://en.wikipedia.org/wiki/Rendering_equation

Model Operation

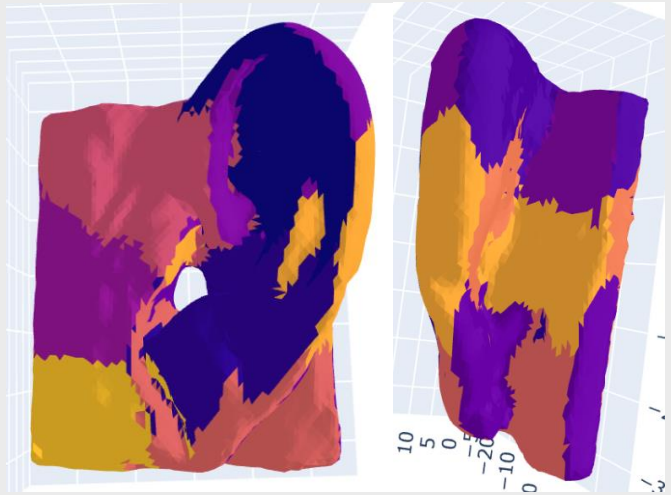


Vector Quantization

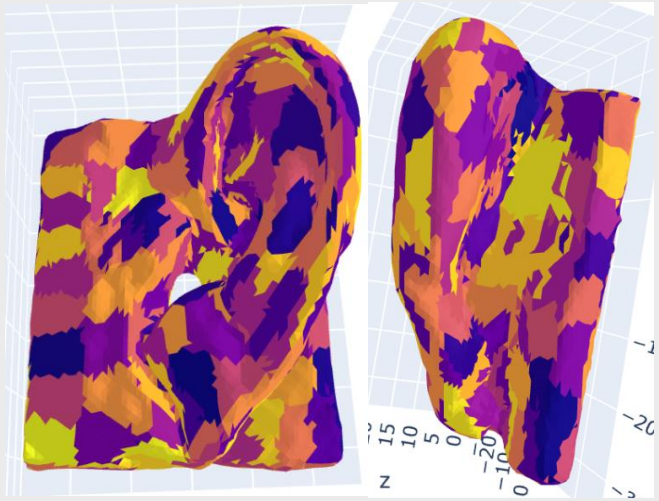
4 codebook vectors



16 codebook vectors



256 codebook vectors



Quartiles:

Norm Var:	0.16, 0.17, 0.18	0.063, 0.094, 0.109	0.0074, 0.0129, 0.0196
Pos Var:	118.1, 118.5, 122.7 mm^2	43.6, 51.5, 58.3 mm^2	2.96, 3.86, 5.44 mm^2
Area:	3179.3, 3276.8, 3453.9 mm^2	752.8, 805.2, 907.8 mm^2	34.8, 55.0, 66.3 mm^2

Next Steps

- Complete prototype encoder network, analyze initial training results
- Investigate using quantization codebook as multihead attention query
- Continue data collection

drive. enable. innovate.

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