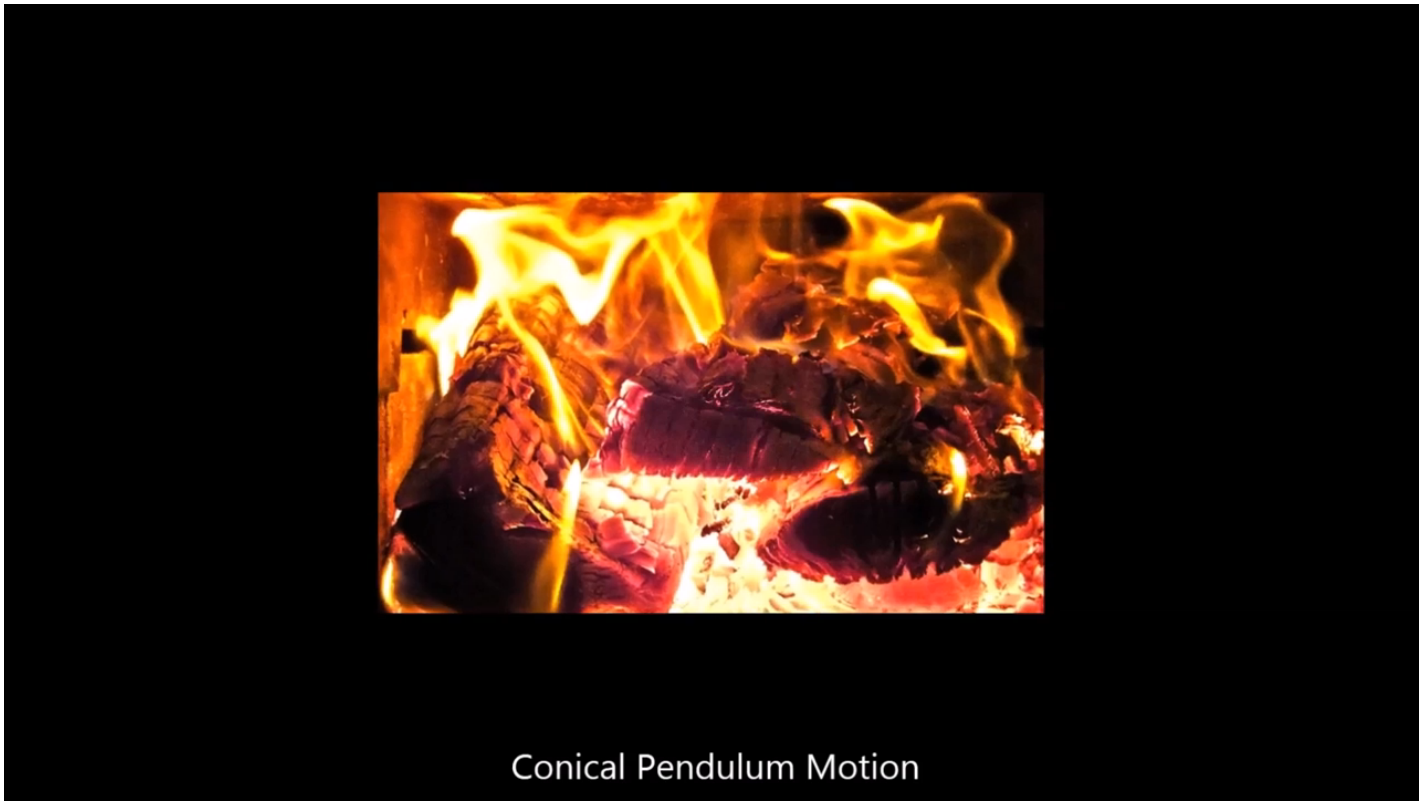
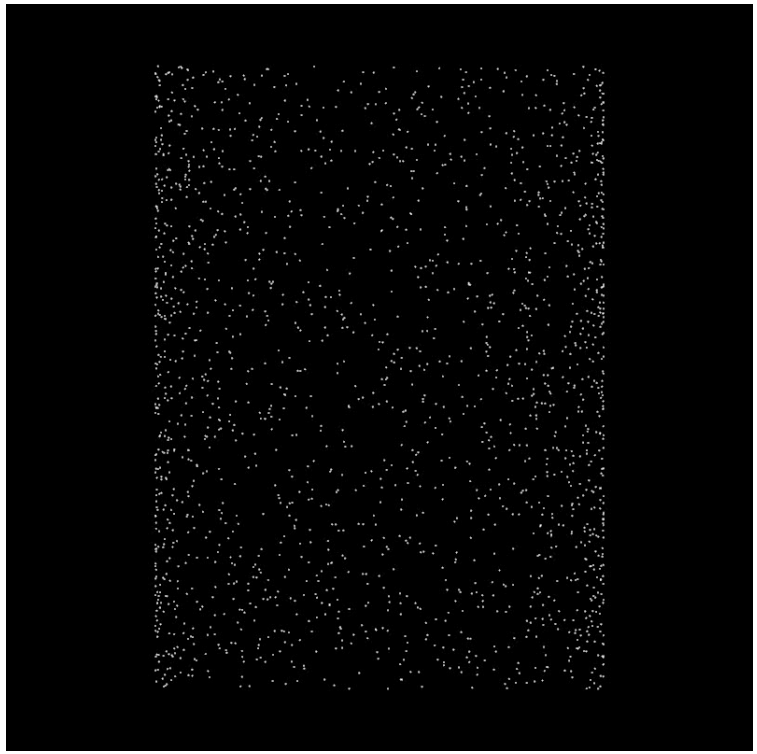
Dynamic experiment

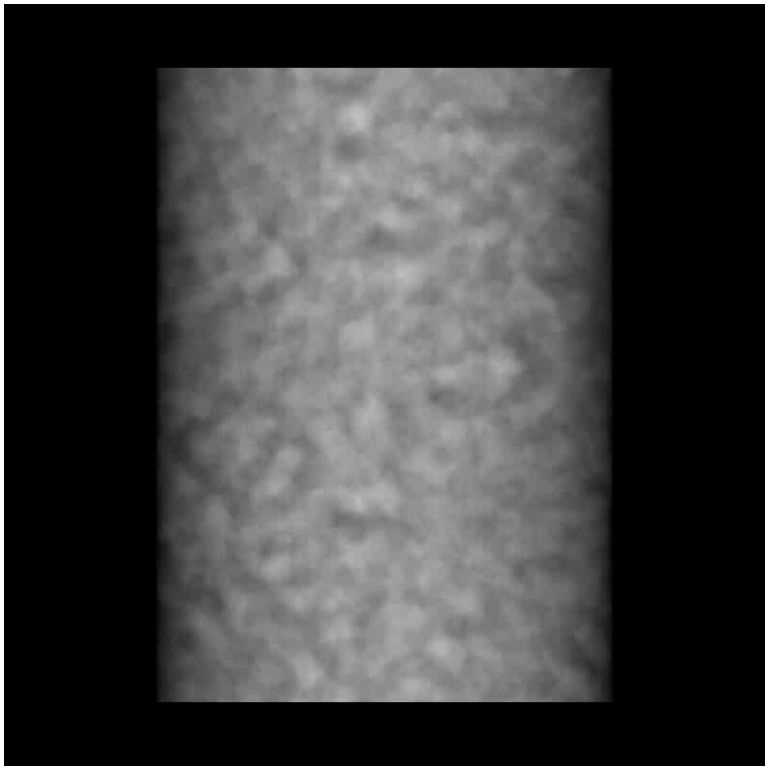
related to the Kinetic Depth Effect



[Bista&al 2016]

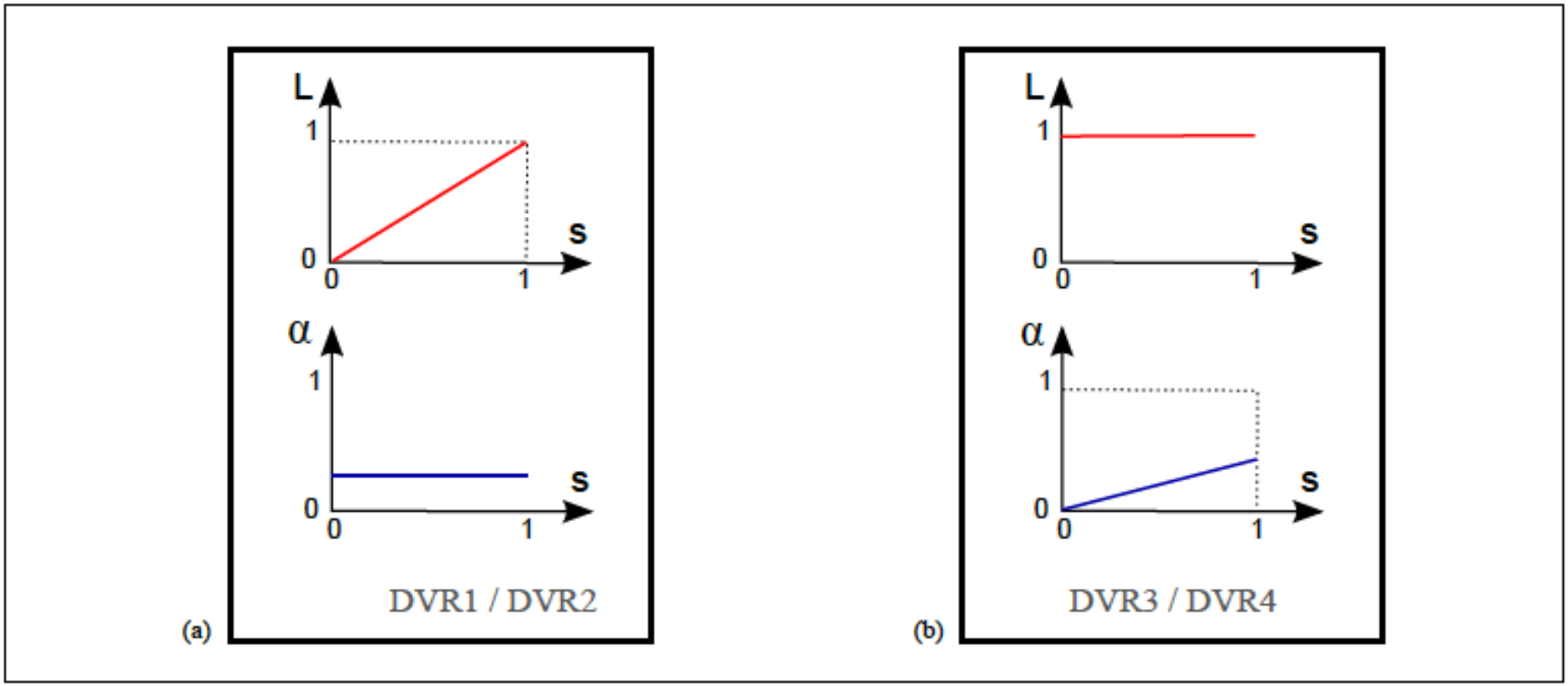
Dynamic experiment



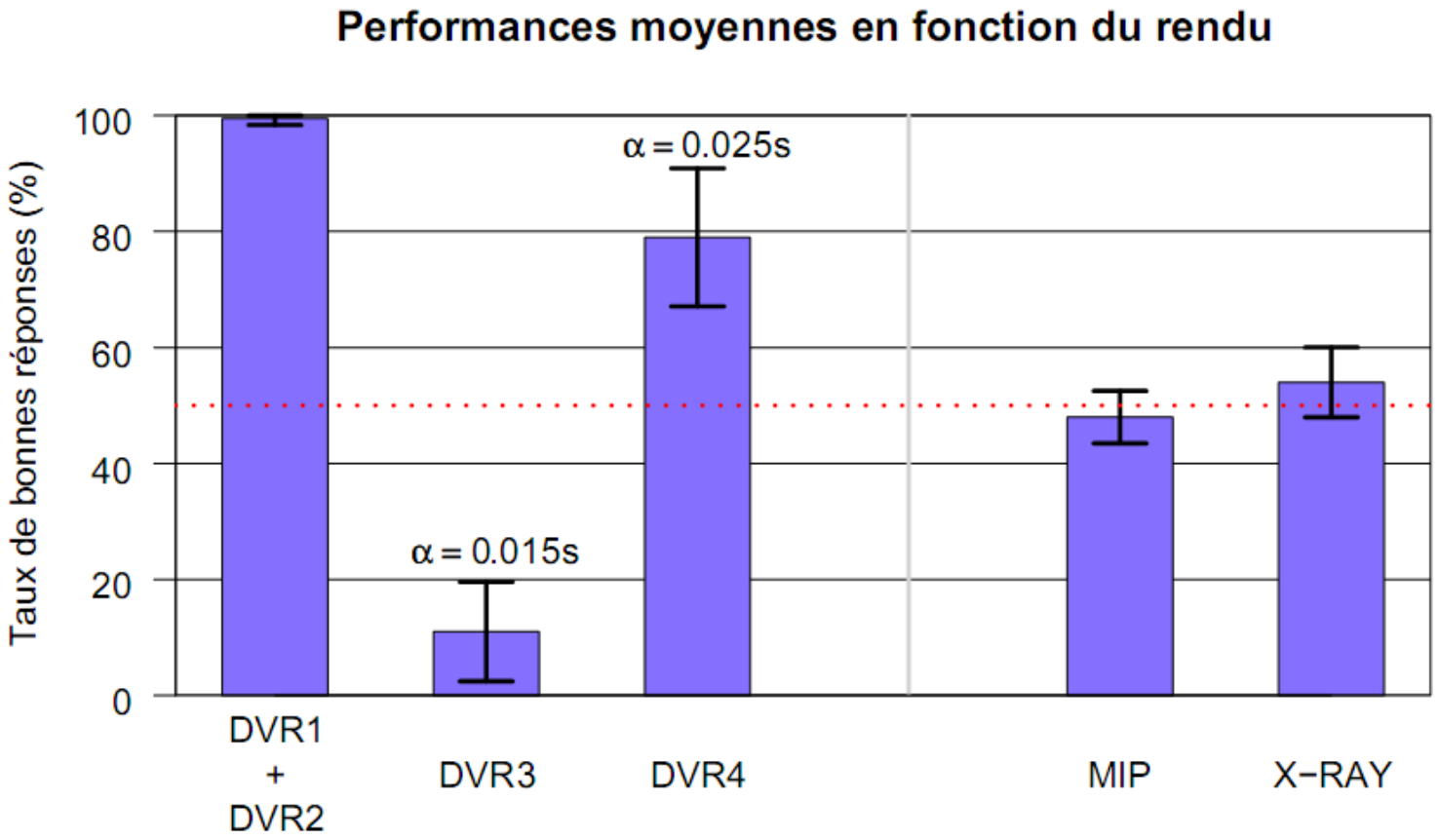


Boucheny, Bonneau & al ACM TAP 2009

Choice of transfer functions

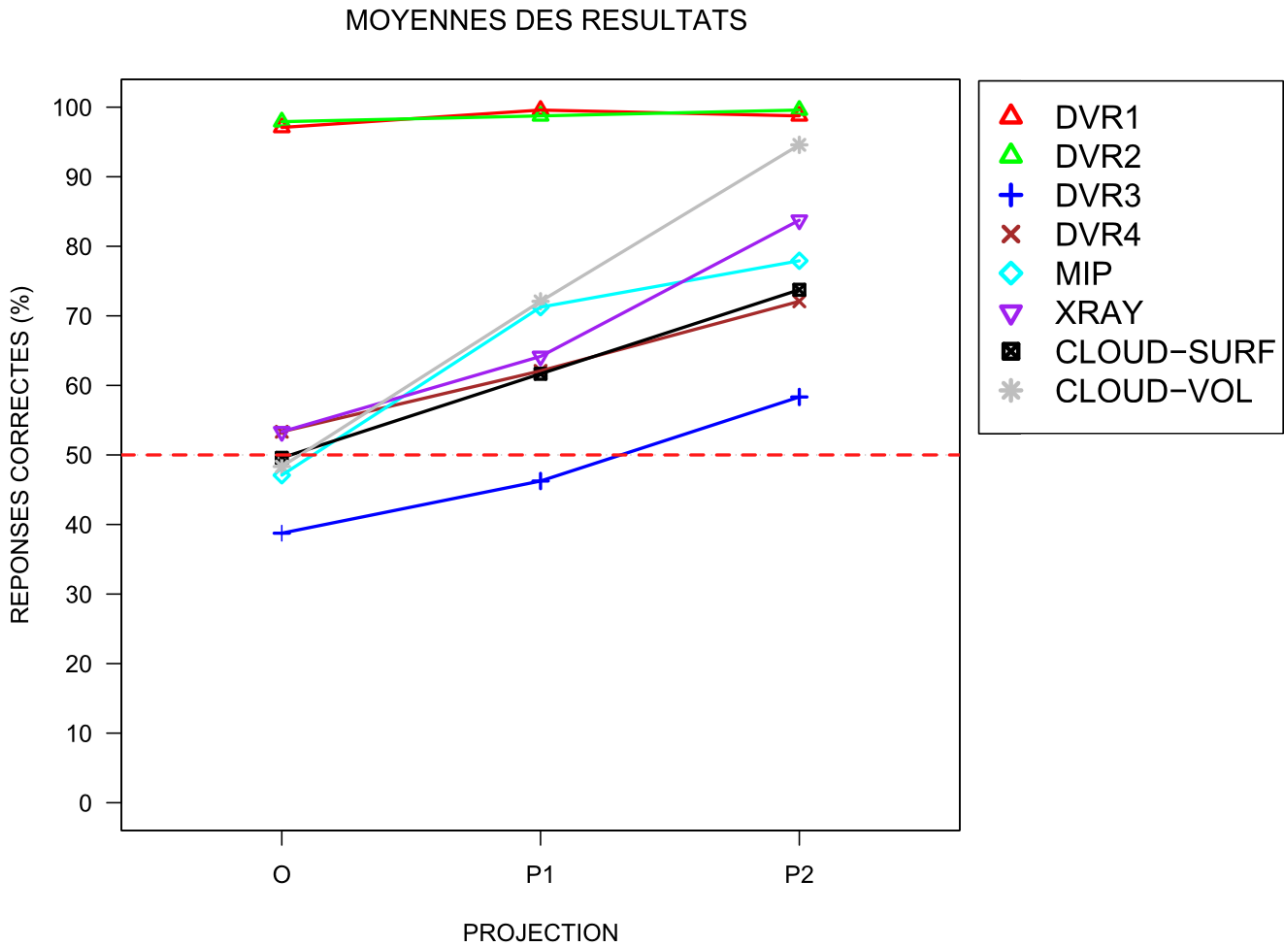


Dynamic experiment results



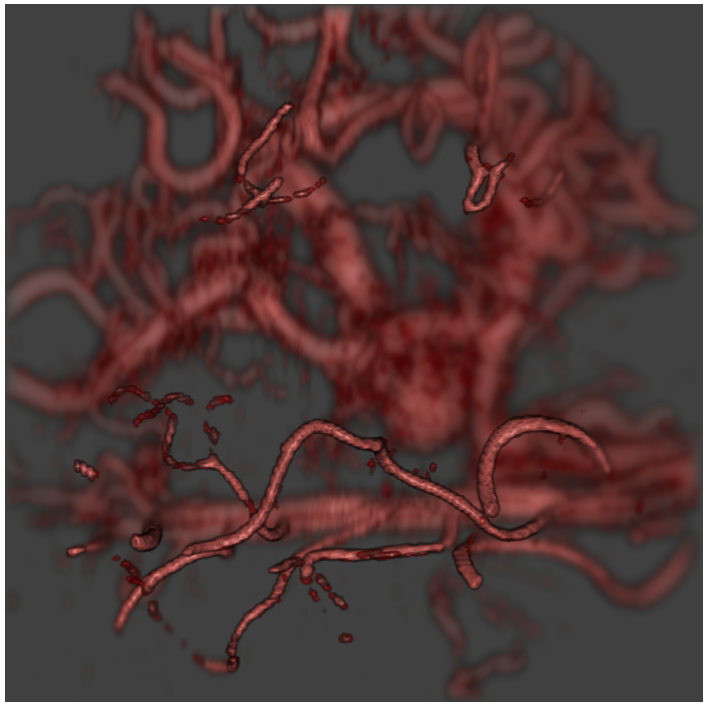
Boucheny, Bonneau & al ACM TAP 2009

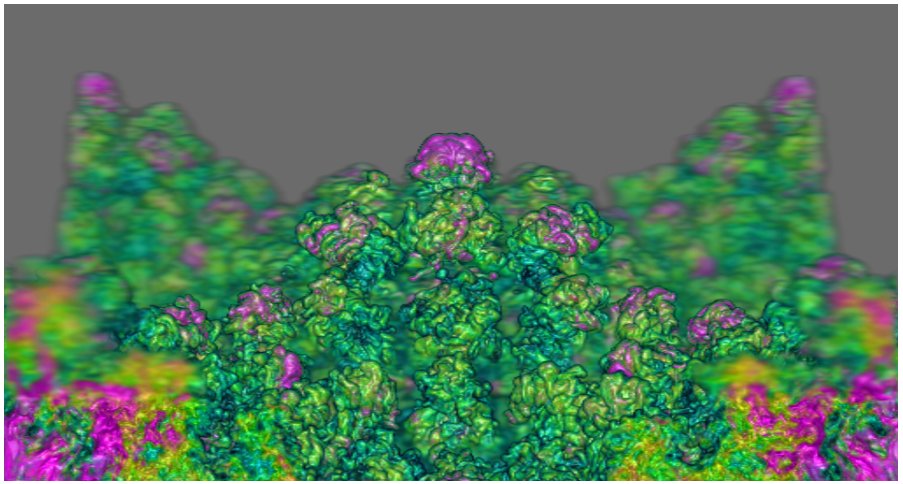
Dynamic experiment results



Boucheny, Bonneau & al ACM TAP 2009

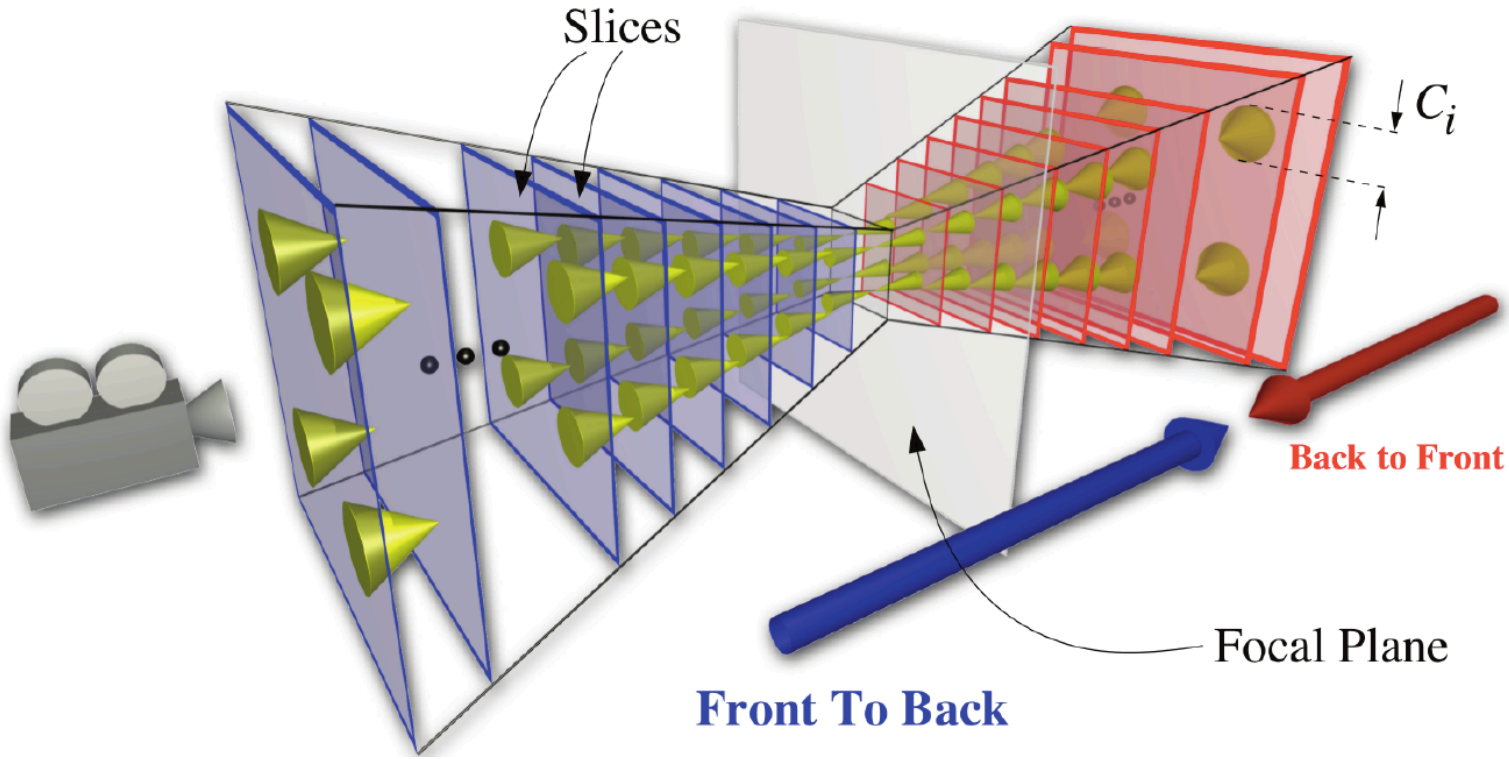
Depth Blur in Direct Volume Rendering





Grosset, Schott, Bonneau, Hansen, Pacific Visualization 2013

Depth Blur in Direct Volume Rendering



Schott, Grosset, martin, Pegoraro, Smith, Hansen, CGF 2009

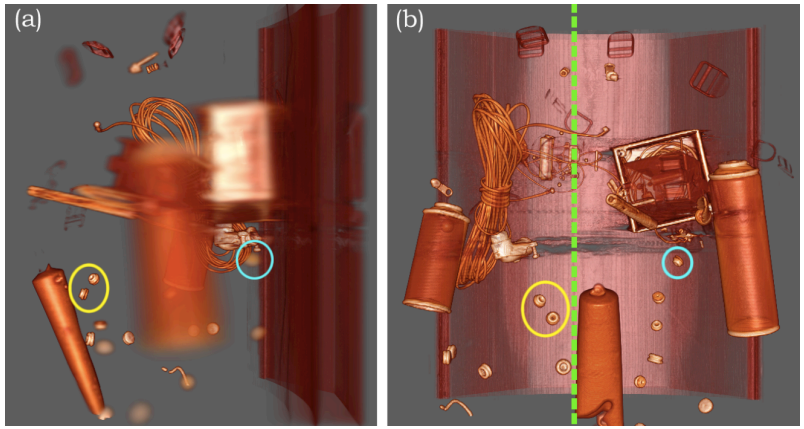
Hypotheses

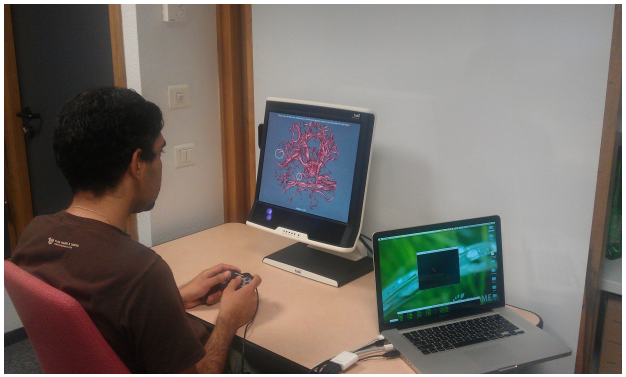
- **HYP 1**: DoF will improve the accuracy of ordinal depth perception in a volume rendered image where there are multiple features.

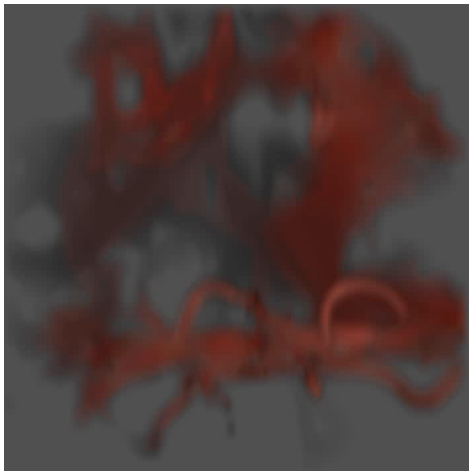
- **HYP 2**: DoF will improve the speed of ordinal depth perception in a volume rendered image where there are multiple features.

- **HYP 3**: If users view a moving focal plane, correct perception of ordinal depth will improve.

Depth Blur Experiment in DVR



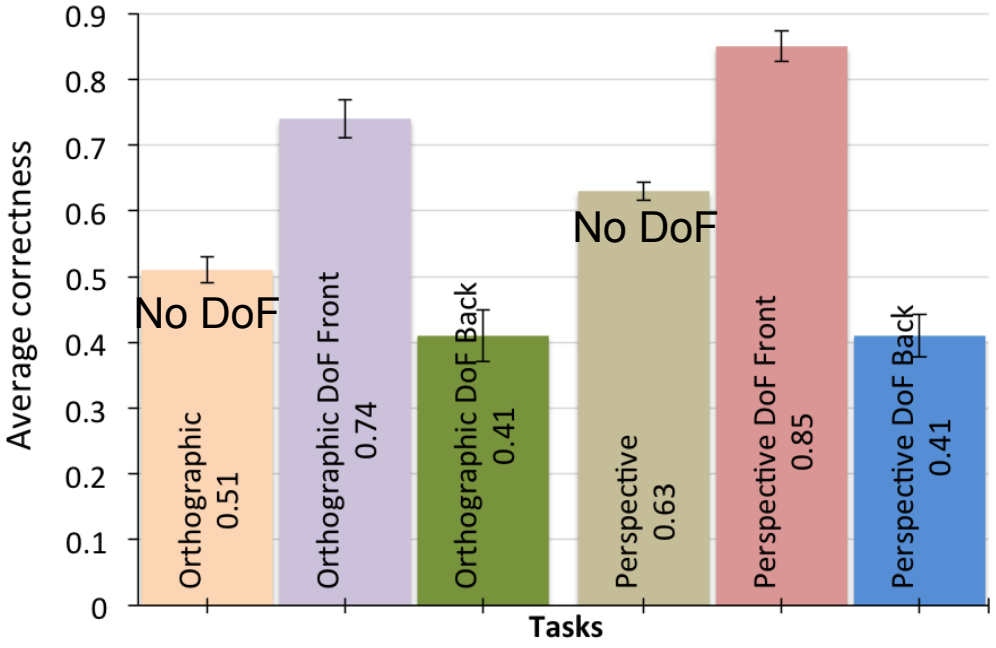


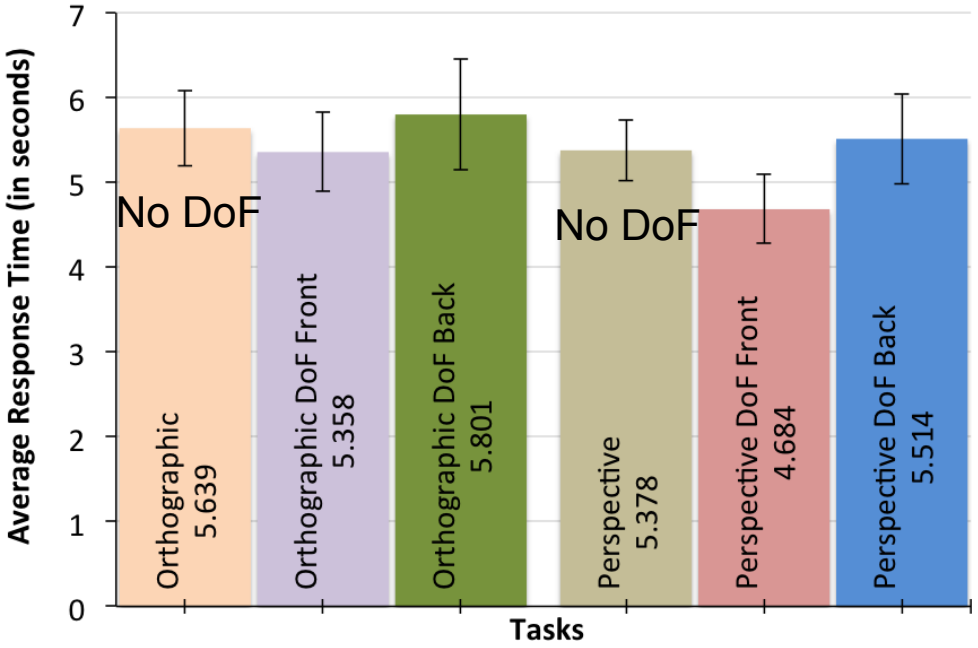


Grosset, Schott, Bonneau, Hansen, Pacific Visualization 2013

Results: Overall

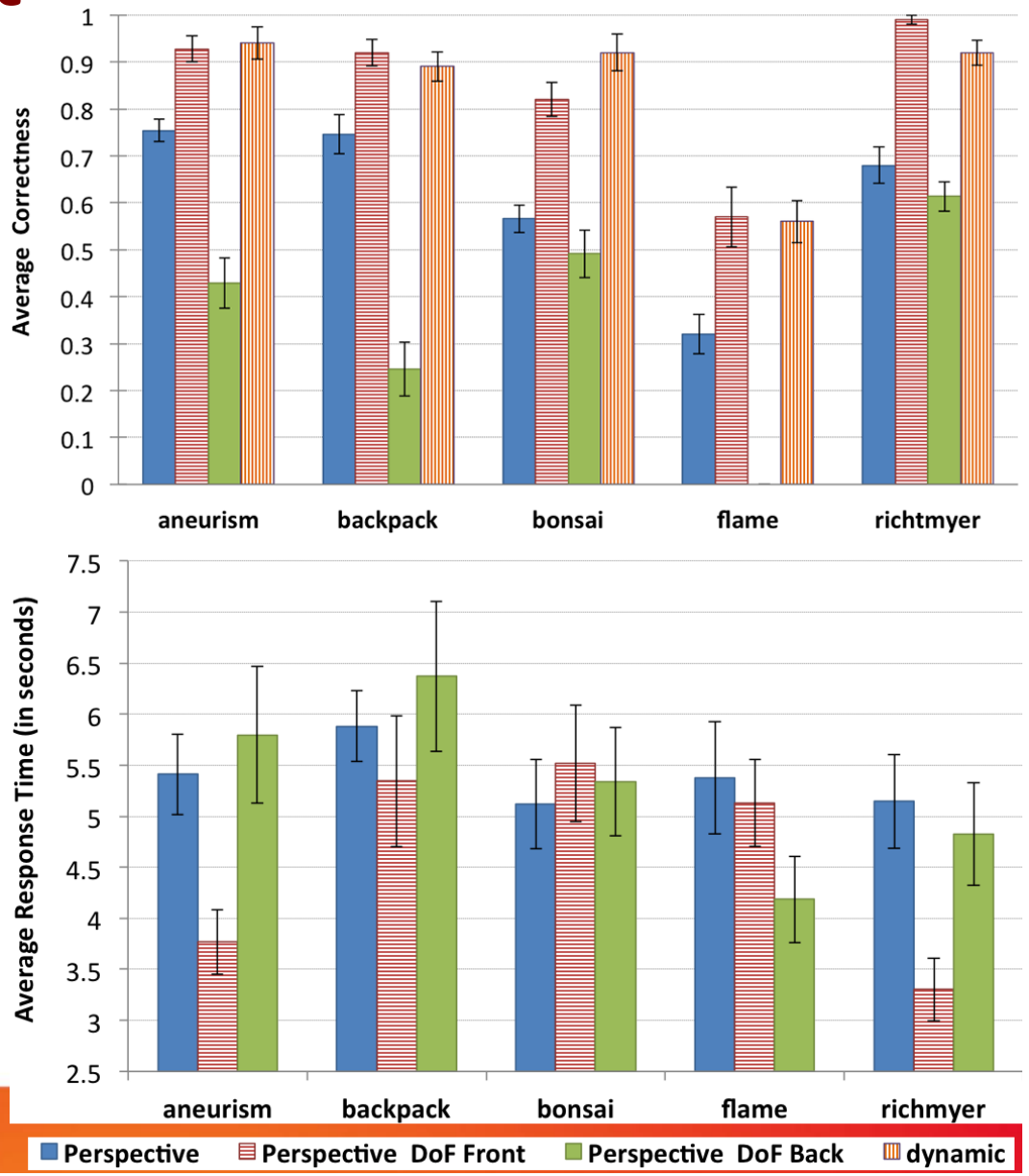
- HYP1 & HYP2
- Depth of Field is NOT always beneficial
  - DoF on Front feature helps
  - DoF on Back feature has reverse effects
  - Why?
    - Depth Cue conflict?





Results: Dataset

- DoF on Front feature is helpful
- Not equally beneficial
  - Translucent datasets are hard to understand

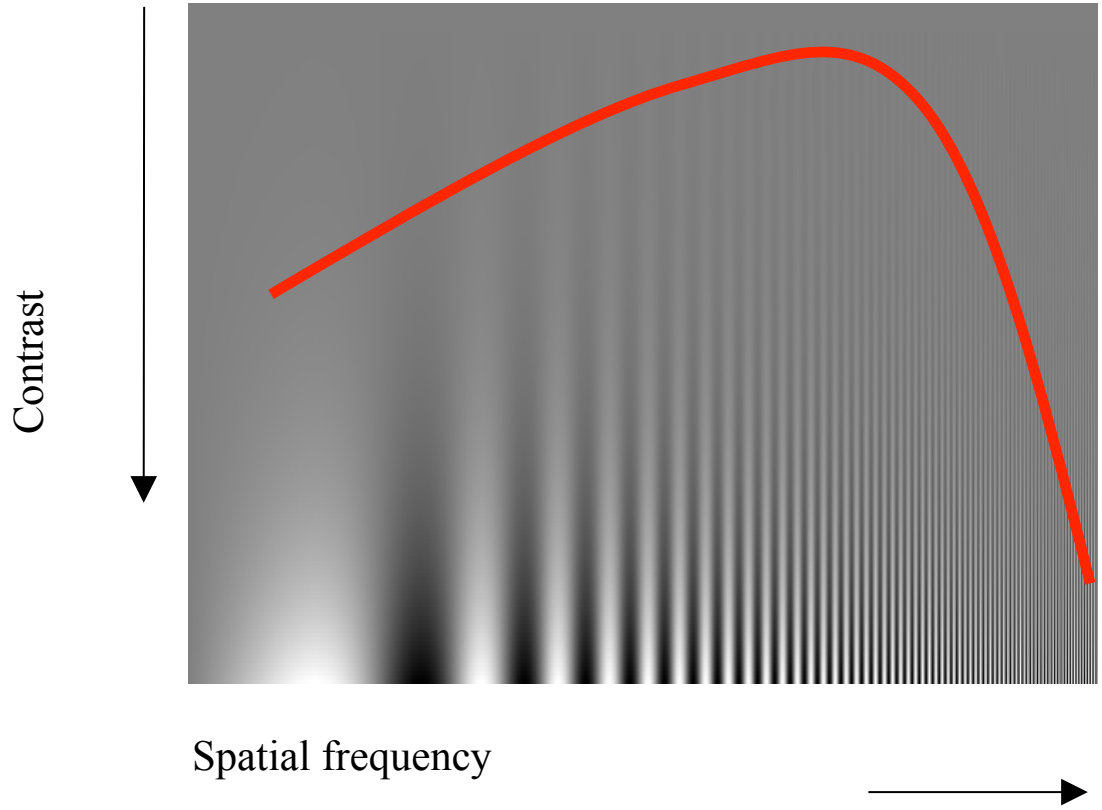


Contrast sensitivity perception

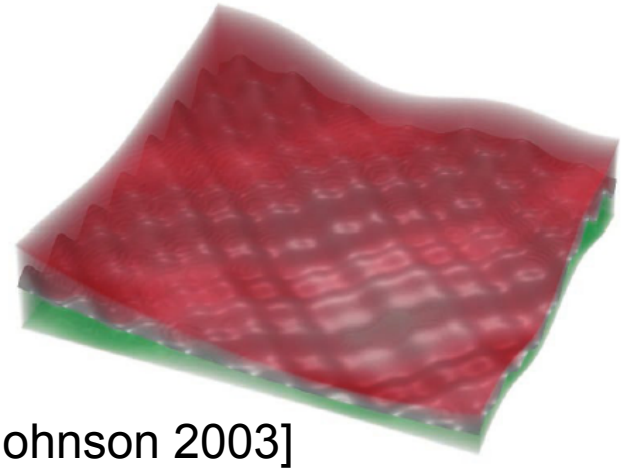
Visualization of Data with Uncertainty

4

Contrast sensitivity function

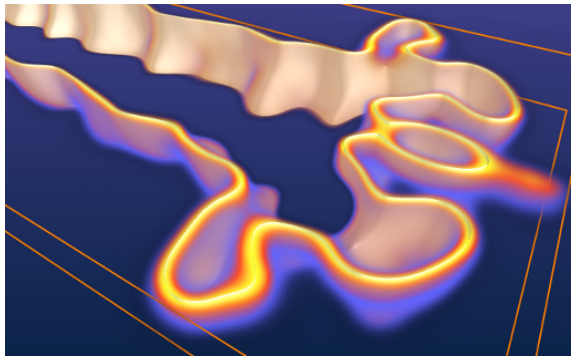


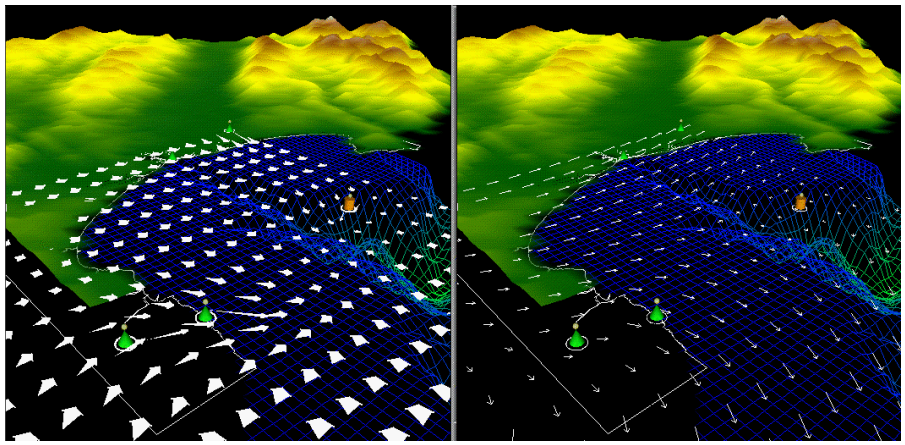
Visualization of Data with Uncertainty



[Johnson 2003]

ZIB 2011

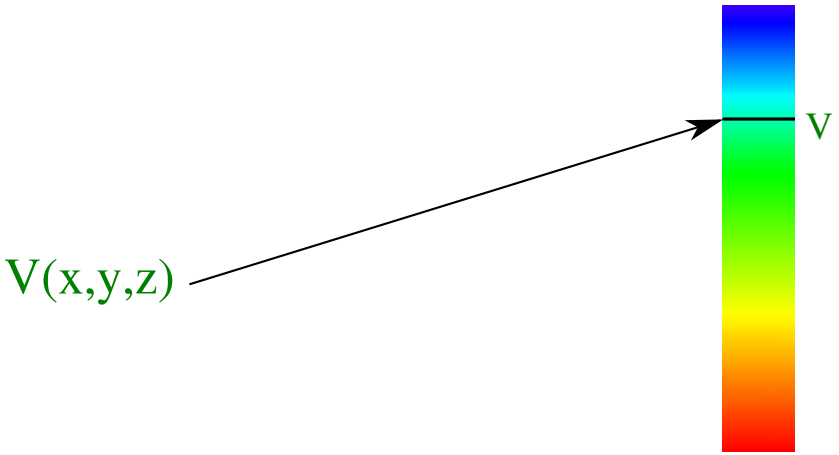


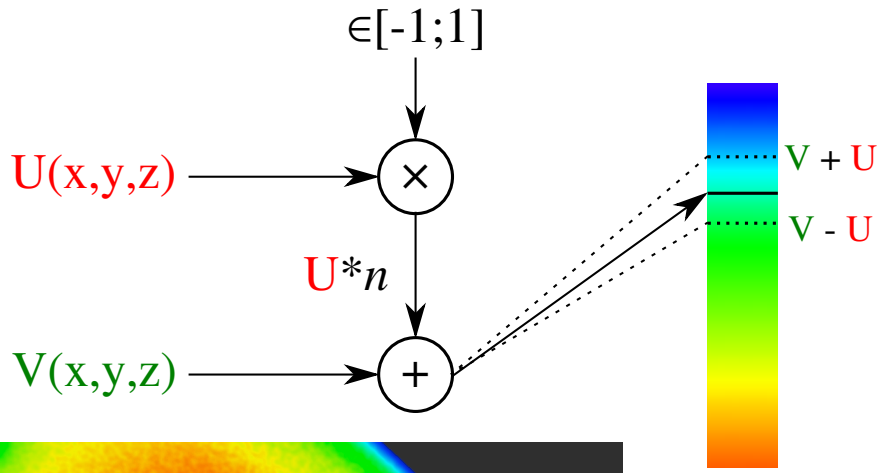


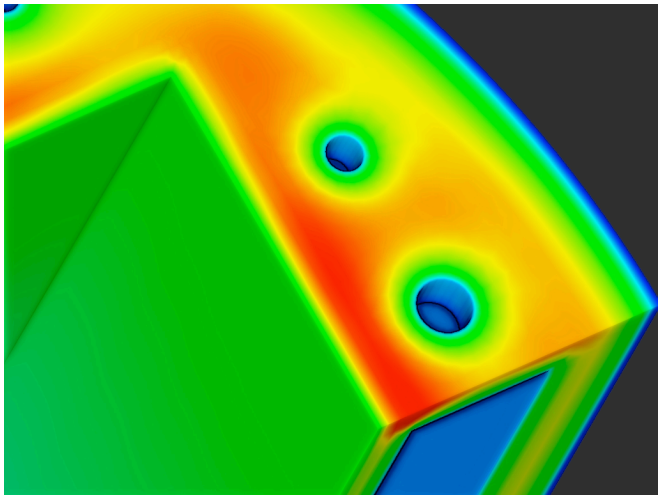
Wittenbrink & al. 1995

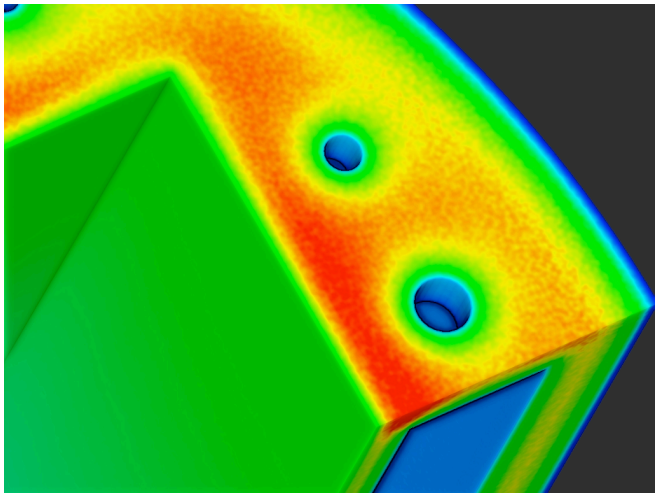
Uncertainty Visualization using Noise

Coninx, Bonneau & al., APGV 2011



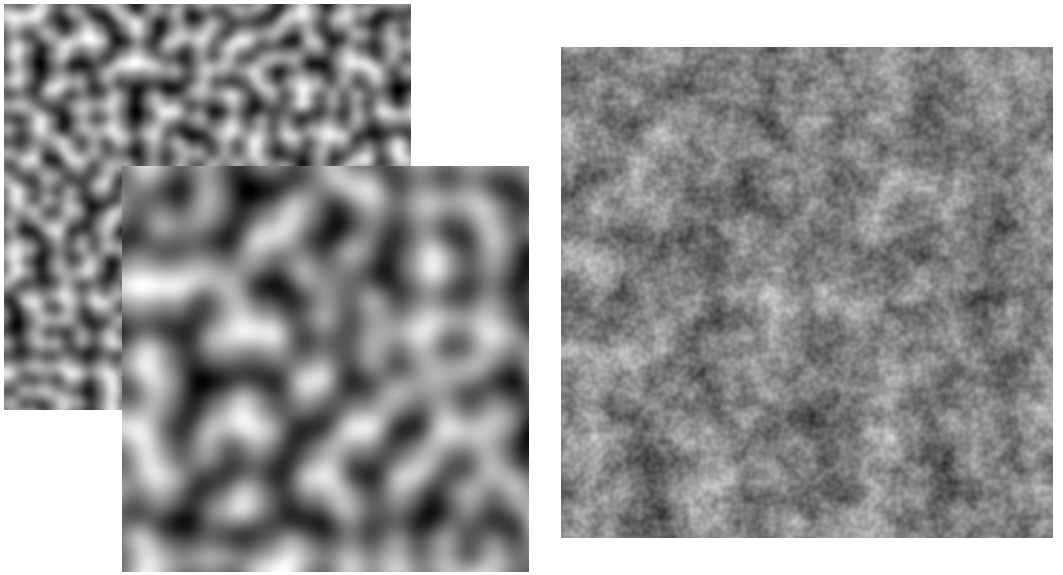


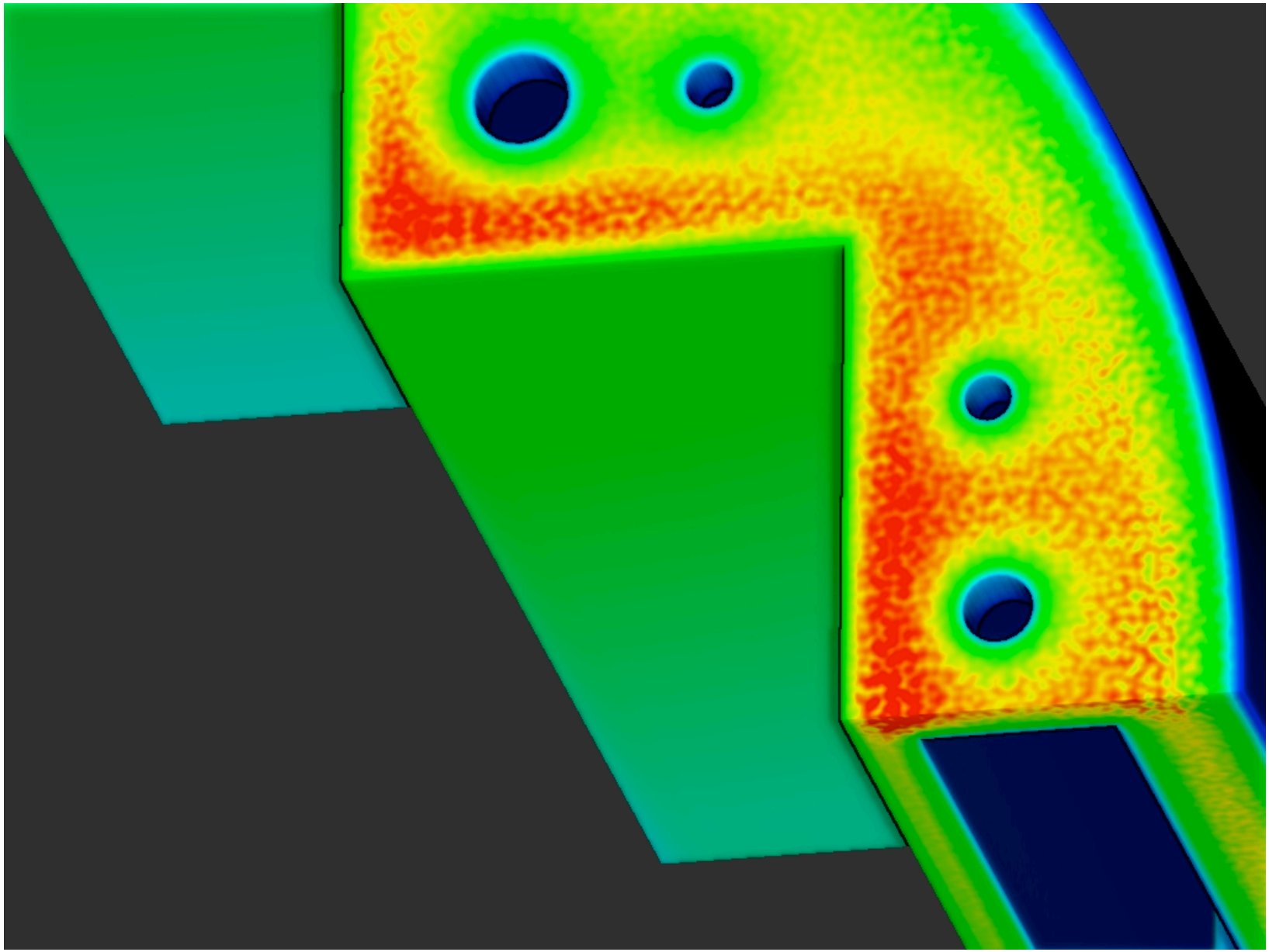




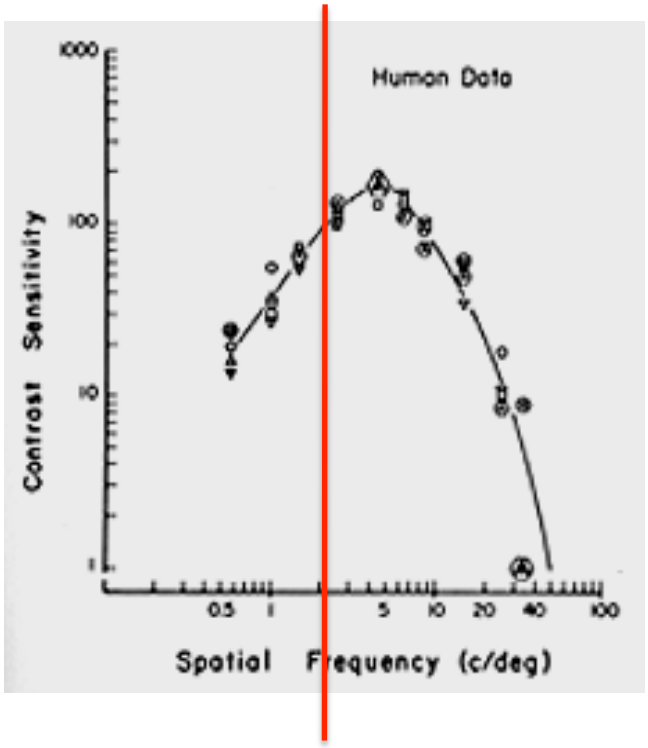
Perlin Noise

$$n_{f_0,p}(\vec{x},t) = \sum_i p^i N(f_0 2^i \vec{x}, t)$$

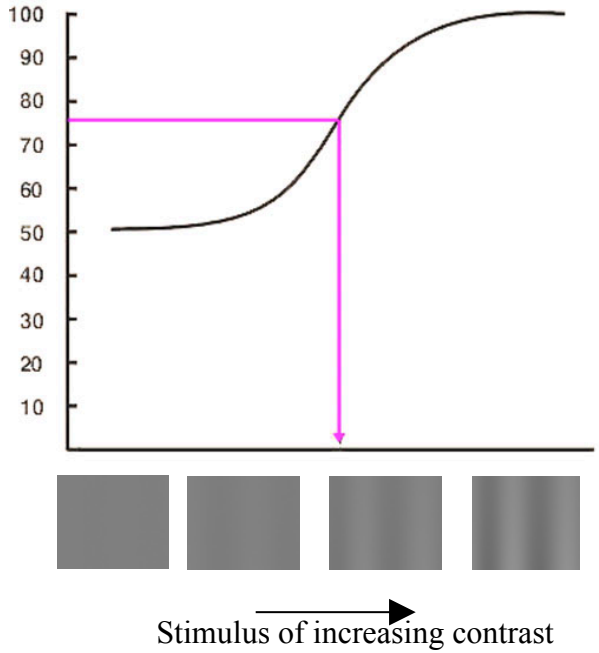




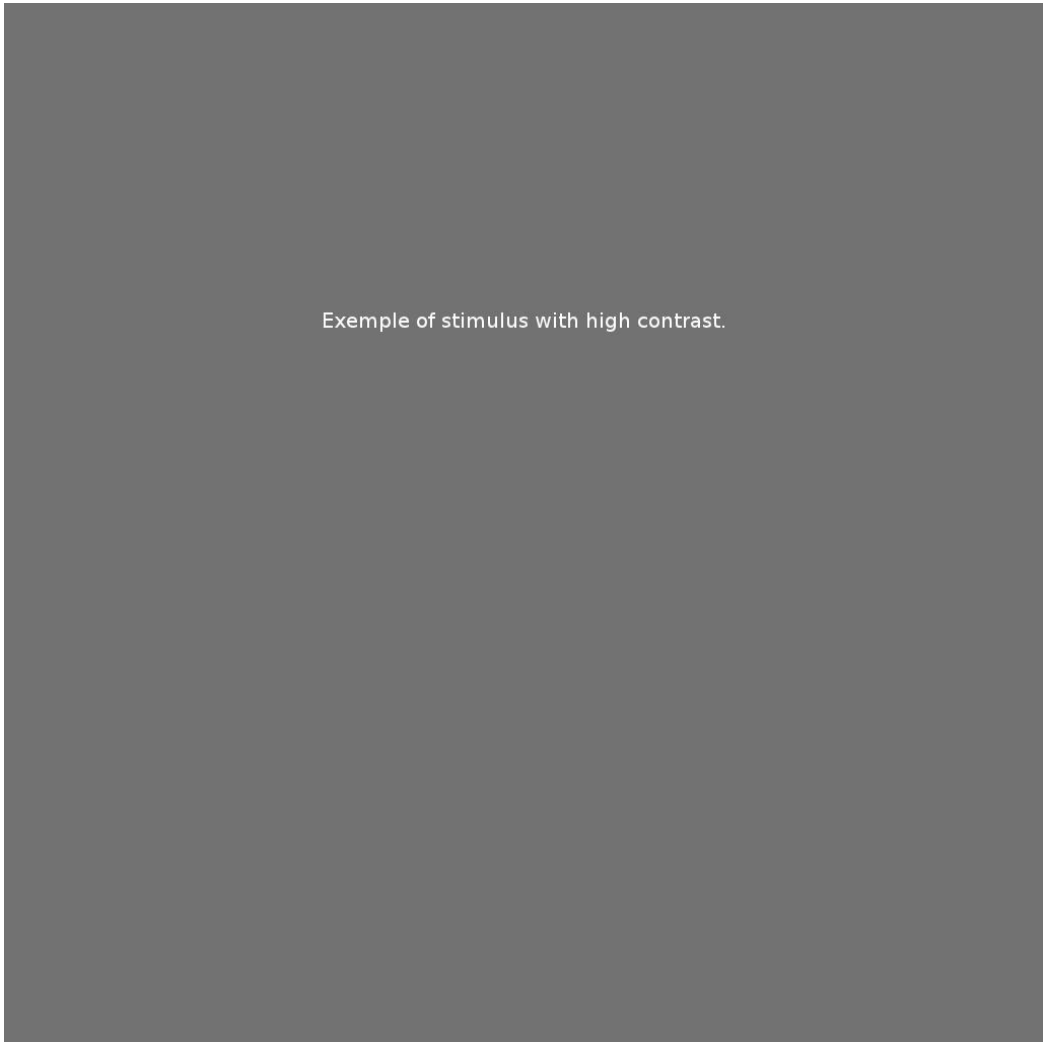
Coninx, Bonneau & al., APGV 2011



DeValois & DeValois (1988)
Spatial Vision. Oxford: Oxford University Press



Stimulus of high contrast



Stimulus near threshold contrast

Psychophysik experiment

- Choice of 4 values of frequency f0 and persistence p

  => 16 stimuli
- f0 = { 2, 4, 8, 16} p = { 0., 0.25, 0.5, 0.75}
- Stimulus of size 256x256
- LCD with pixel size 0.295mm, screen-subject distance 2m

  => 120 pixels per degree
- 30 questions to measure a threshold => 30 * 16 = 480 quest., ~5s for each quest. => ~40mn duration for each subject

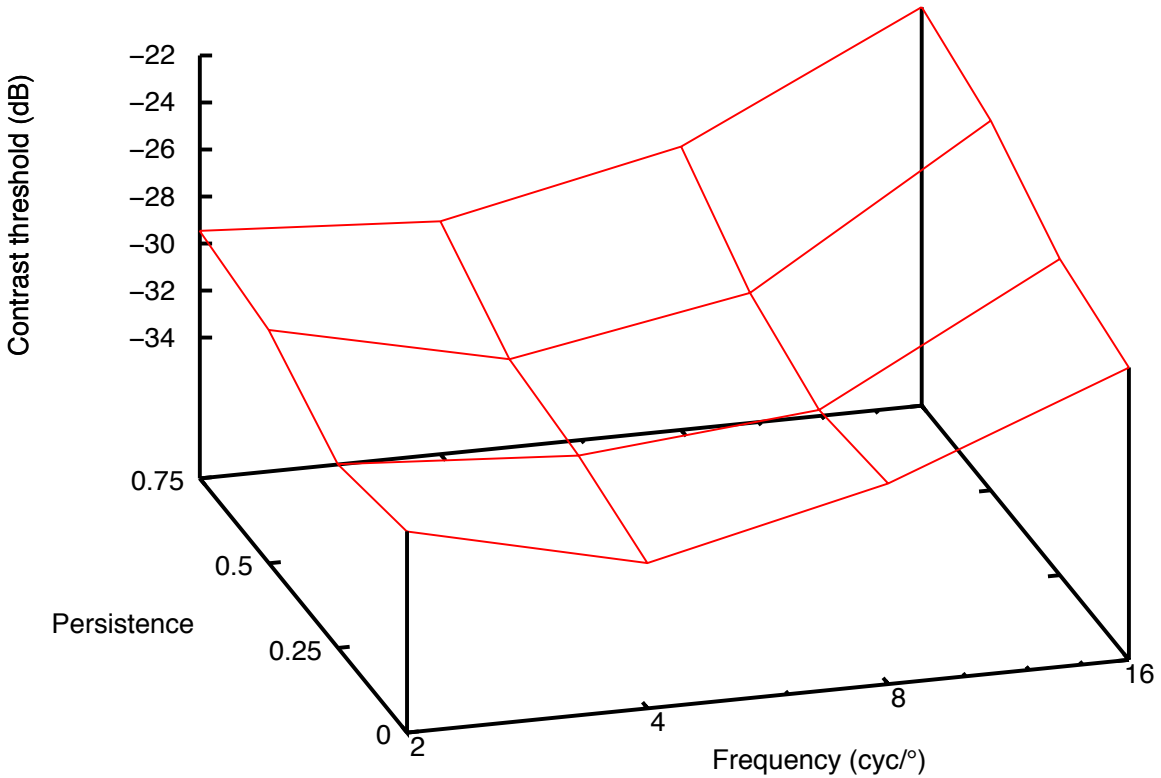
Psychophysik experiment pitfalls

- Eliminate all biases in the stimuli
- Calibrate screen precisely
- resolution in gray value must be < 0.25% of measured threshold

…

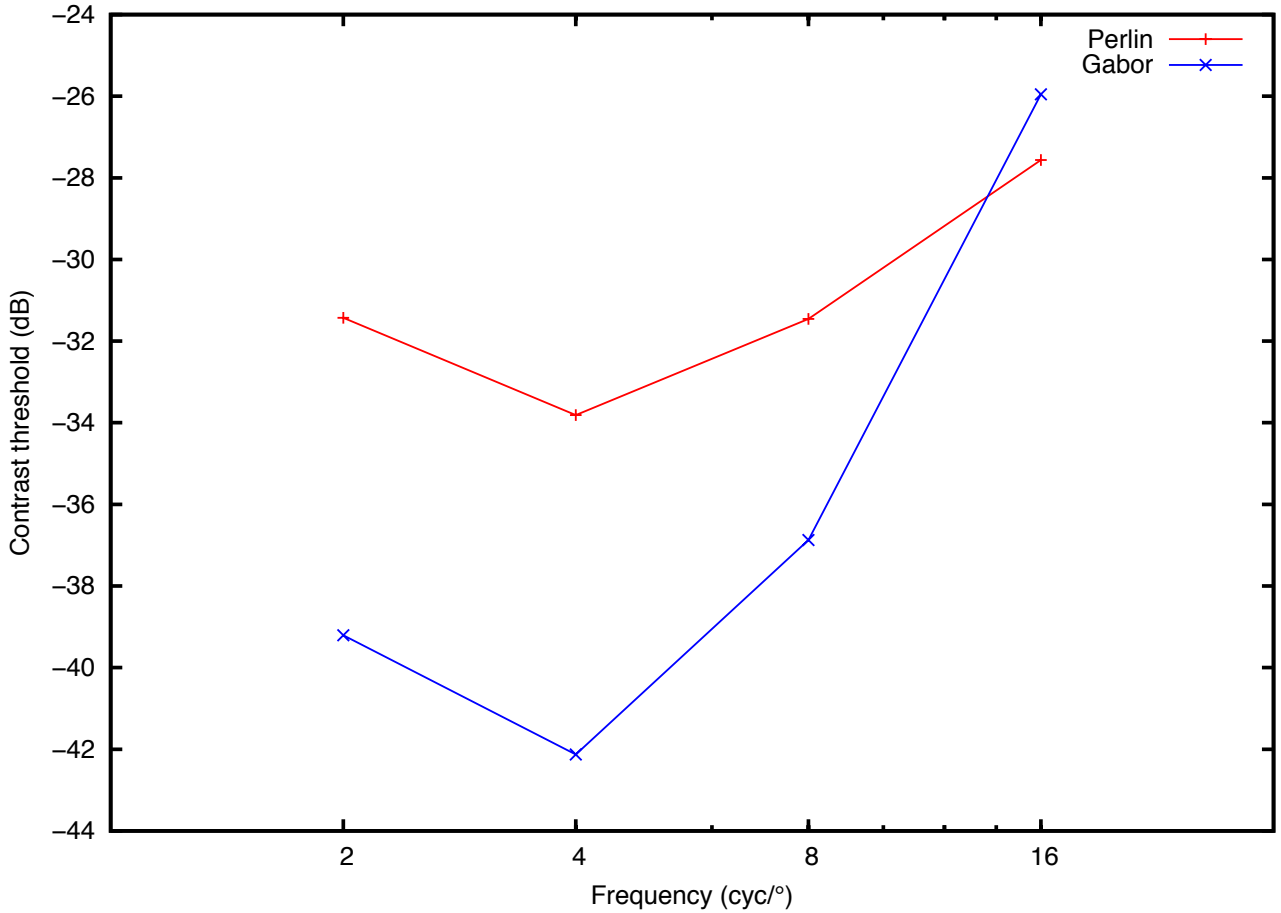
=> necessary to collaborate with perception experts!

Sensitivity Thresholds for Perlin Noise

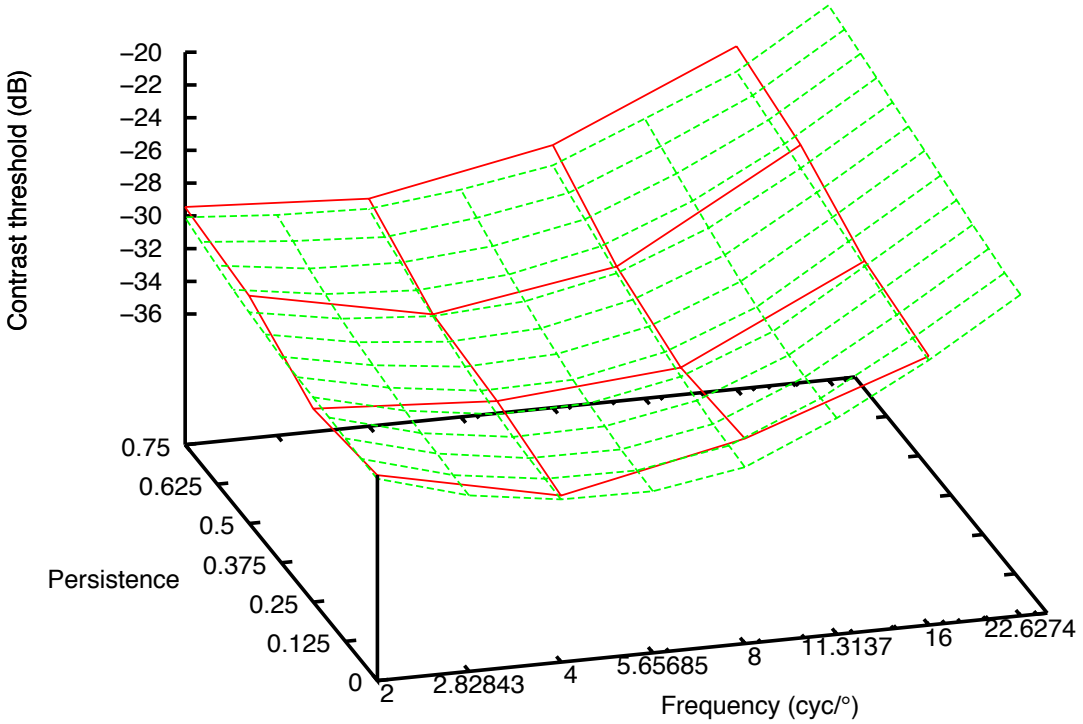


Coninx, Bonneau & al., APGV 2011

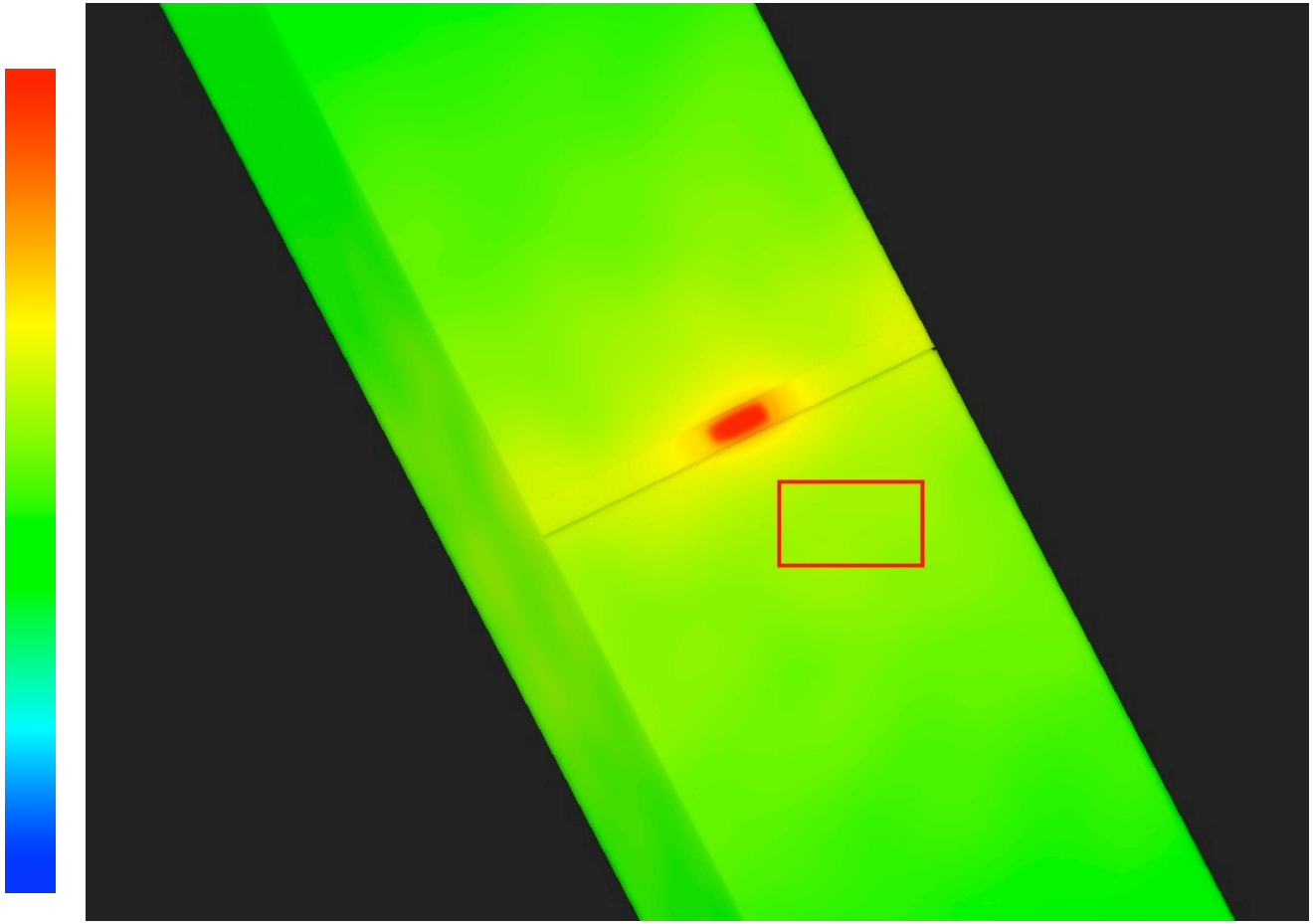
Threshold for Regular vs. Stochastic Stimuli

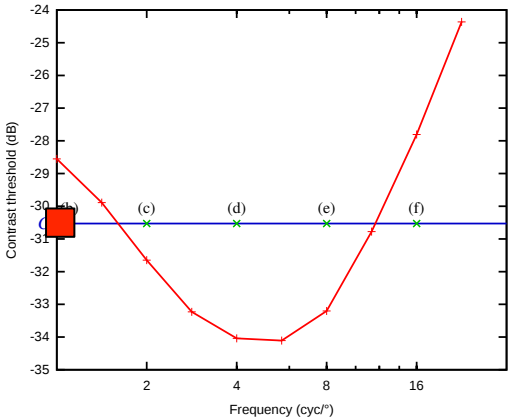


Model for Automatic Threshold Computation



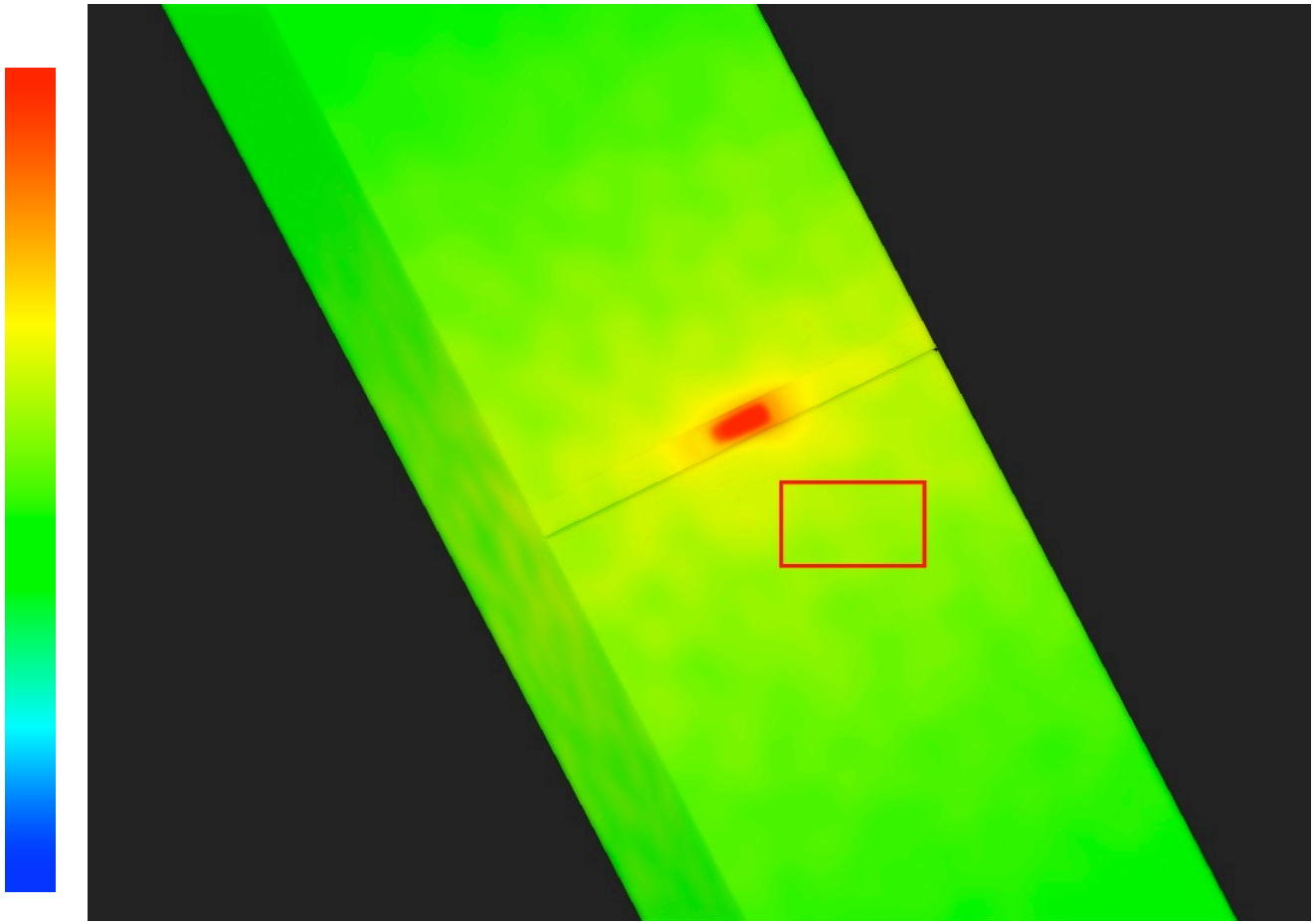
Using Sensitivity Thresholds

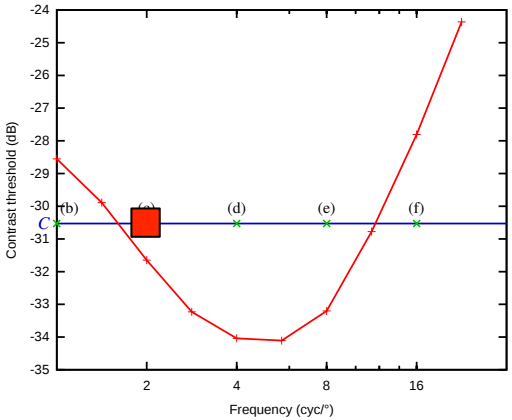




Coninx, Bonneau & al., APGV 2011

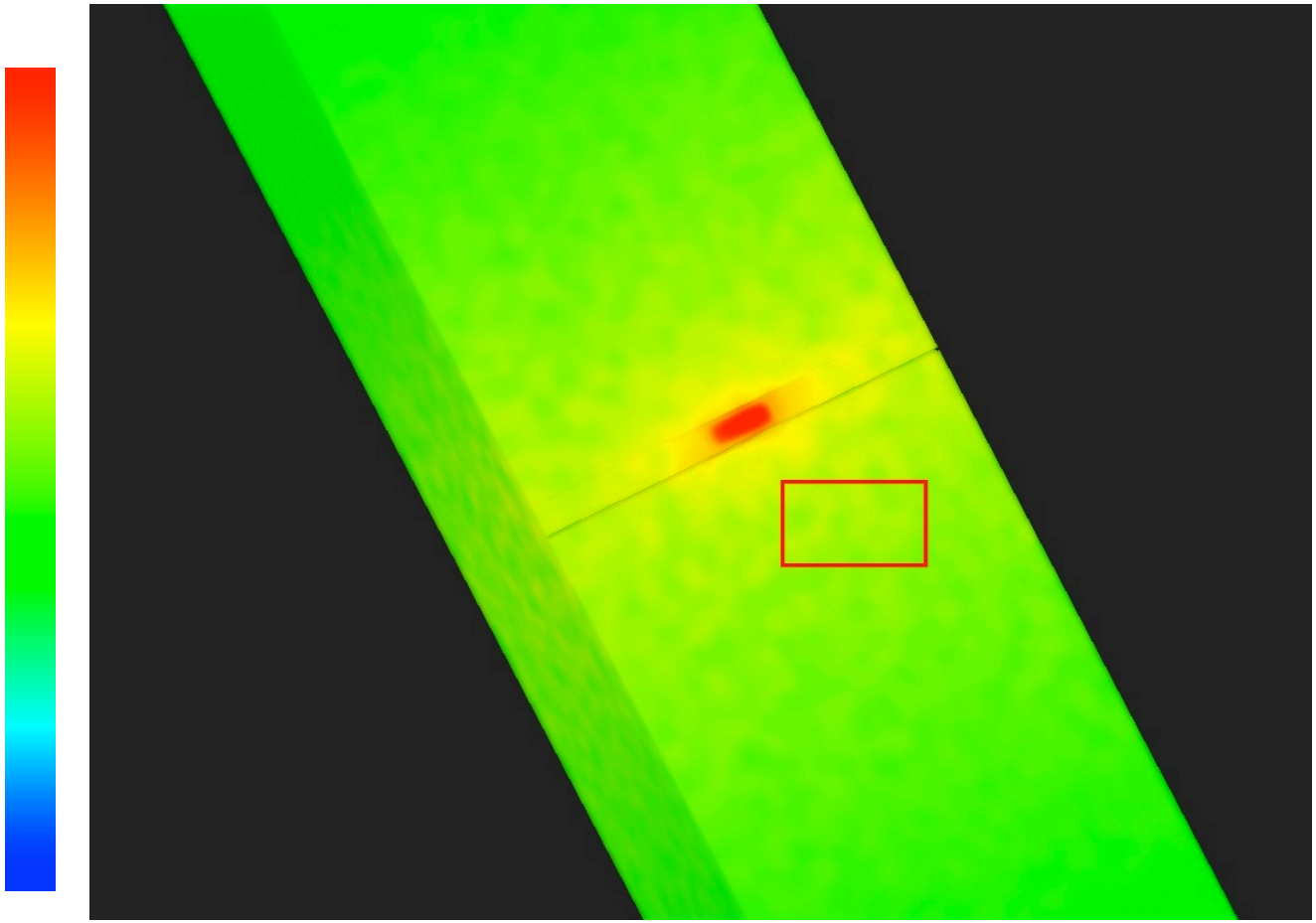
Using Sensitivity Thresholds

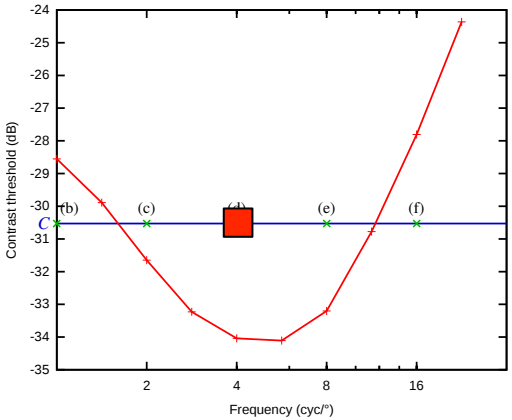




Coninx, Bonneau & al., APGV 2011

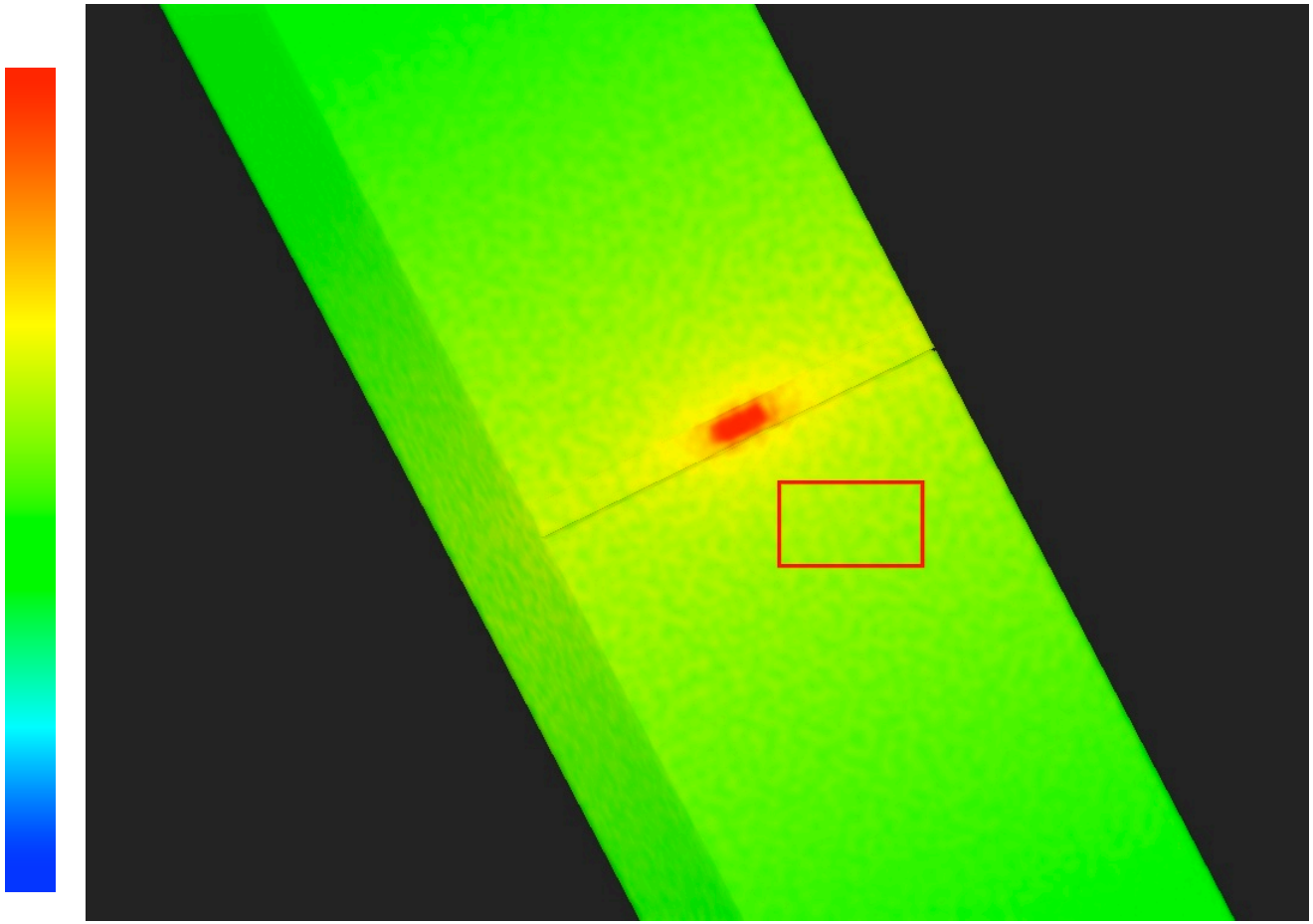
Using Sensitivity Thresholds

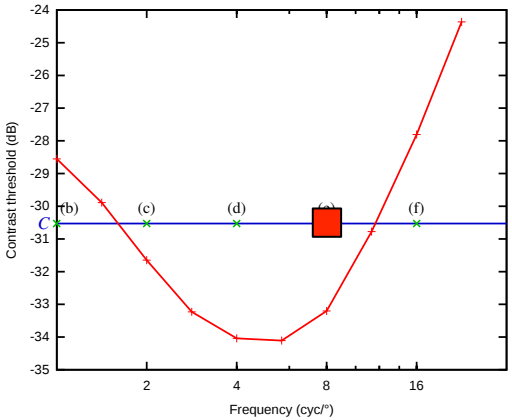




Coninx, Bonneau & al., APGV 2011

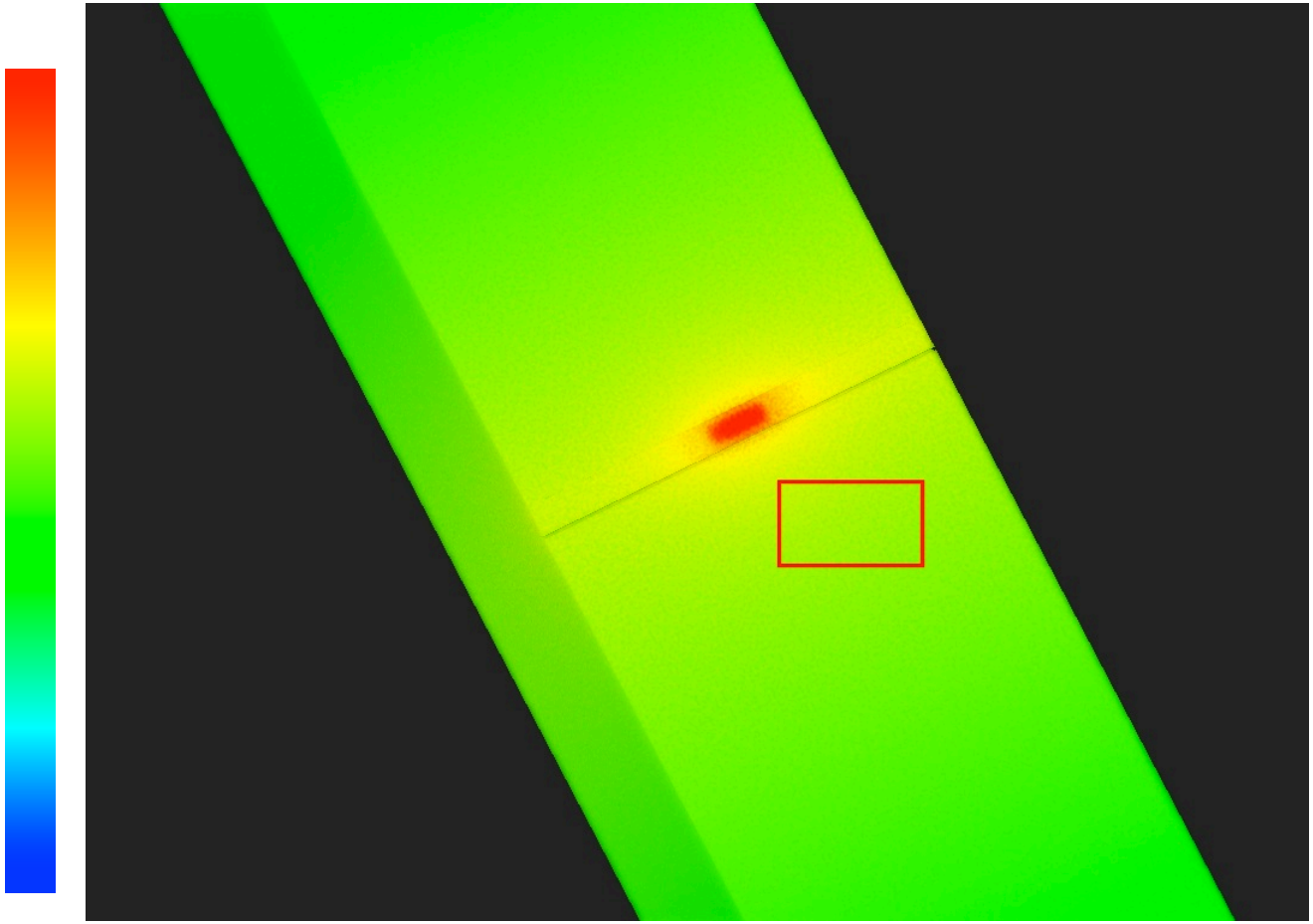
Using Sensitivity Thresholds

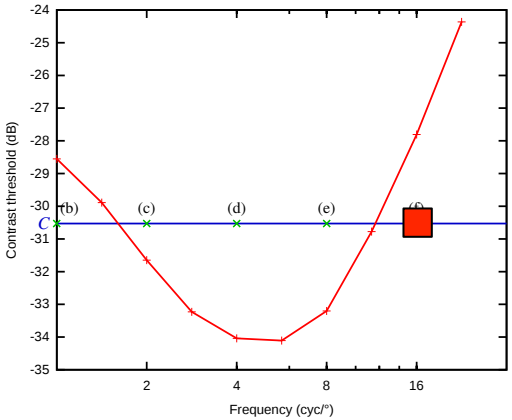




Coninx, Bonneau & al., APGV 2011

Using Sensitivity Thresholds





Coninx, Bonneau & al., APGV 2011

Perception of shape

Image based shape manipulation

5

Modifying Perceived Shape by Warping

R. Vergne, P. Barla, G.-P. Bonneau, R.W. Fleming
Flow-Guided Warping for Image-Based Shape Manipulation
Siggraph 2016

Related Works

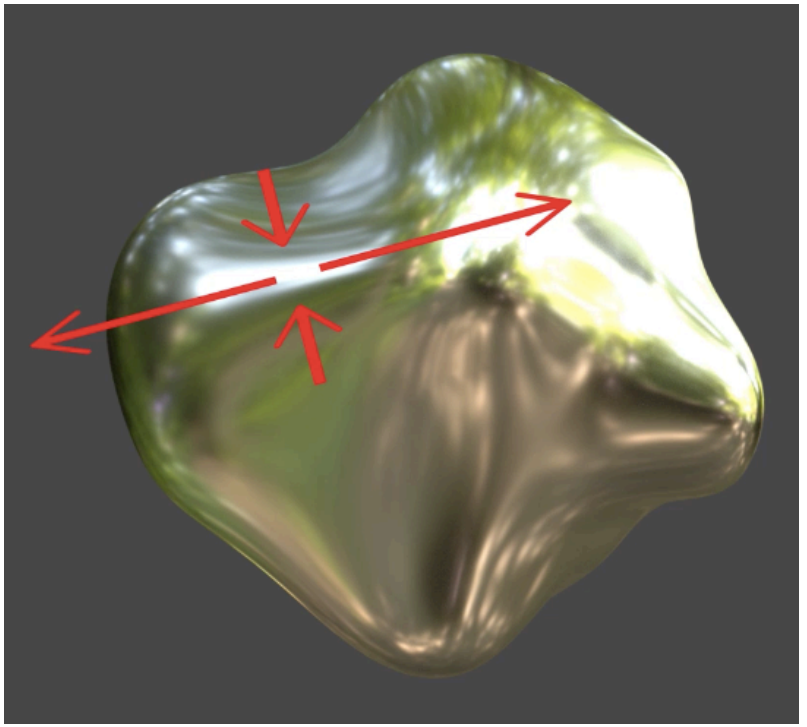
- Image manipulation
- [Boyadzhiev et al.2015] [Wu et al. 2012] [Wadhwa et al. 2013] [Wadhwa et al. 2015]

  [Dekel et al. 2015] [Bousseau et al. 2009] [Yeung et al. 2011]

- 3D Reconstruction
- [Khan et al. 2006] [Guttierrez et al. 2008] [Luft et al. 2006] [Kholgade et al. 2014] [Vergne et al. 2012]

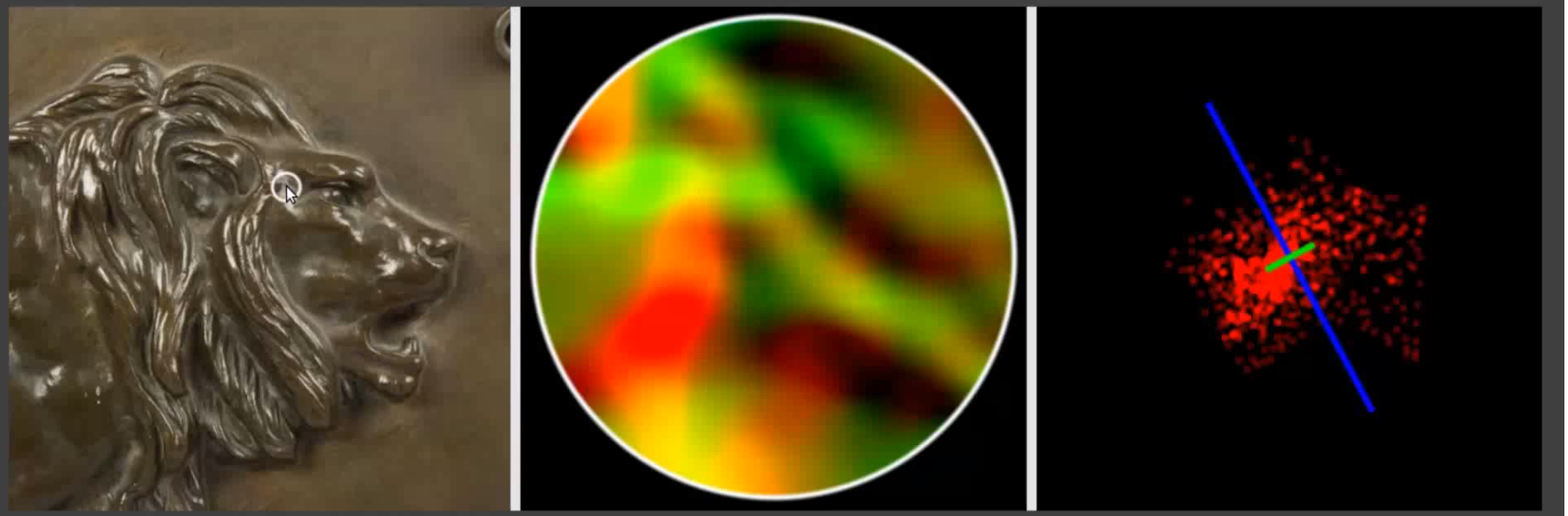
- Shape perception
- [Horn and Brooks 1989] [Oren and Nayar 1997] [Koenderink and van Doorn 1980] [Fleming et al. 2004] [Fleming et al. 2011] [Caniard and Fleming 2007] [Mooney and Anderson 2014].

How do we perceive shape?



Measuring Orientation Patterns

Orientation patterns are measured by the structure tensor



circle centered at pixel P

intensity gradients in circle

structure tensor at P