Using Blur to Affect Perceived Distance and Size

Authors:

Held, Robert T

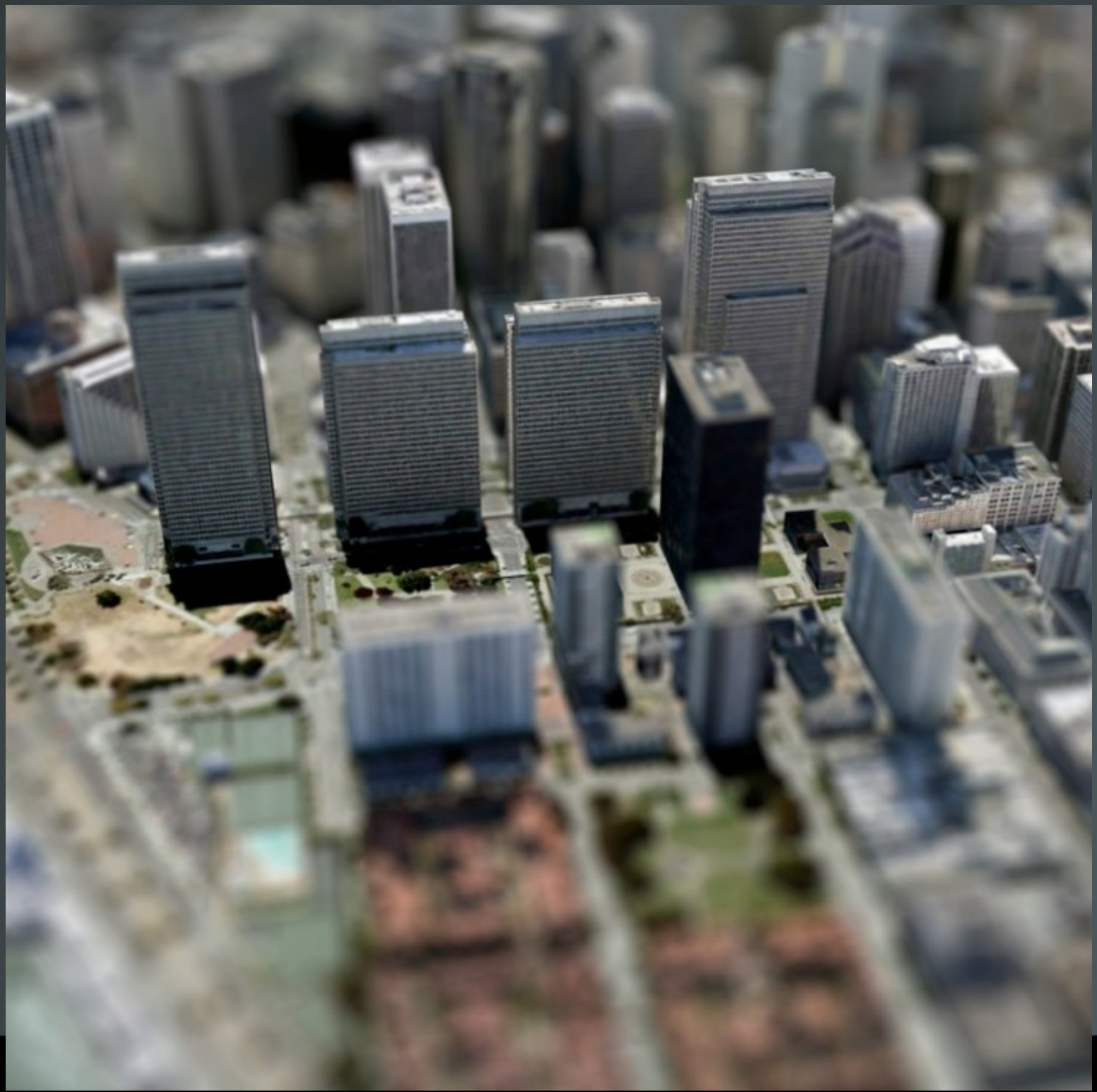
Cooper, Emily a

O'Brien, James F

Banks, Martin S

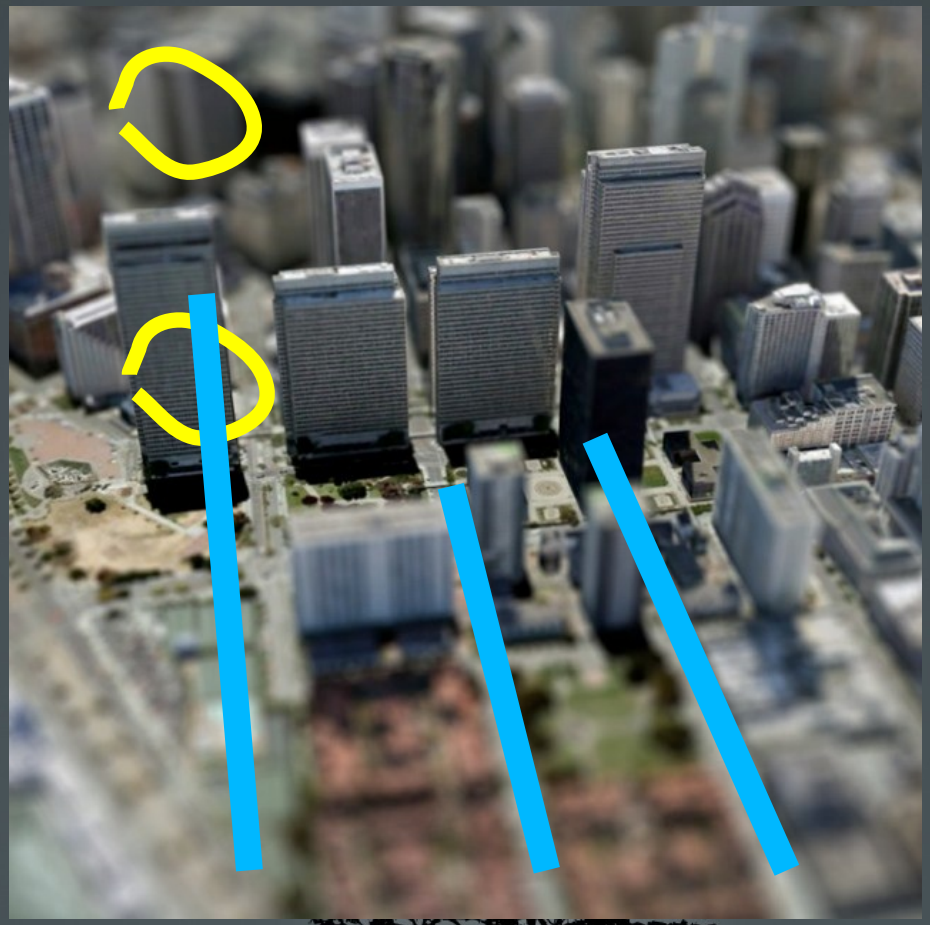
Presentation by **Armin Samii**
Discussion with **Dustin Shean**

Some slides copied from the authors.



How do we sense depth?

- Blur
  - Naturally in our eyes
  - More blurry = further (from focal plane)
- Perspective, e.g.
  - Converging parallel lines
  - Occlusion



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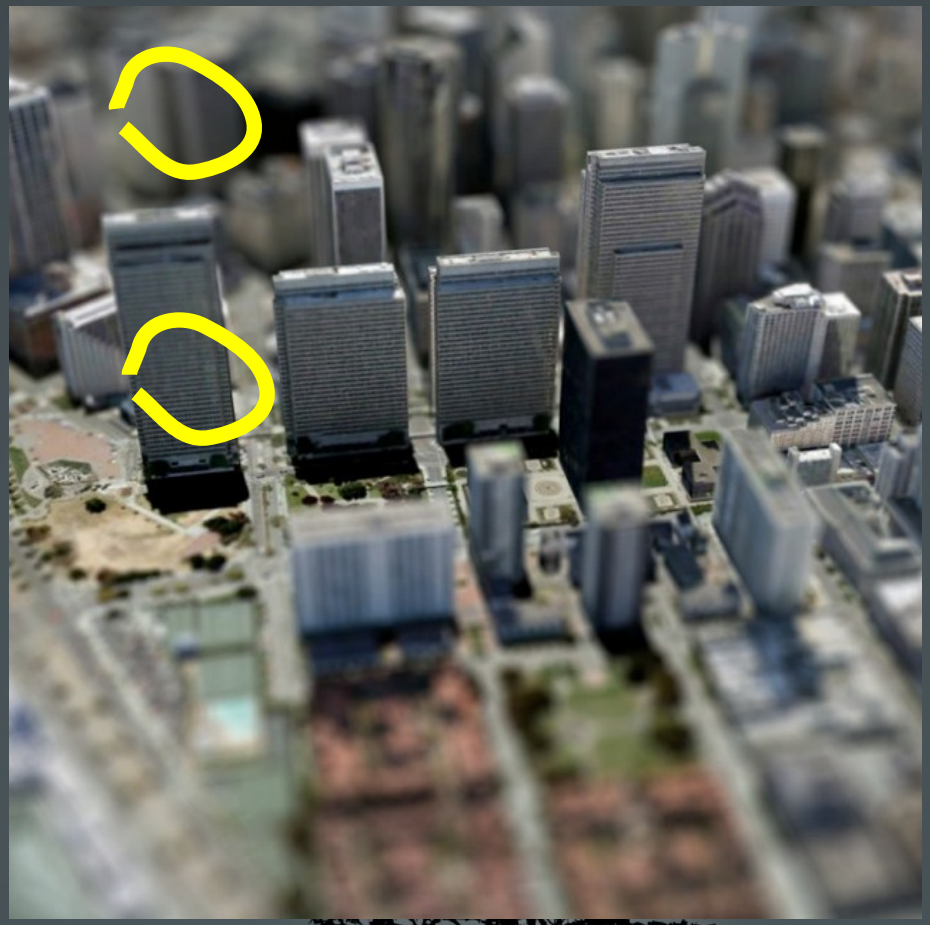
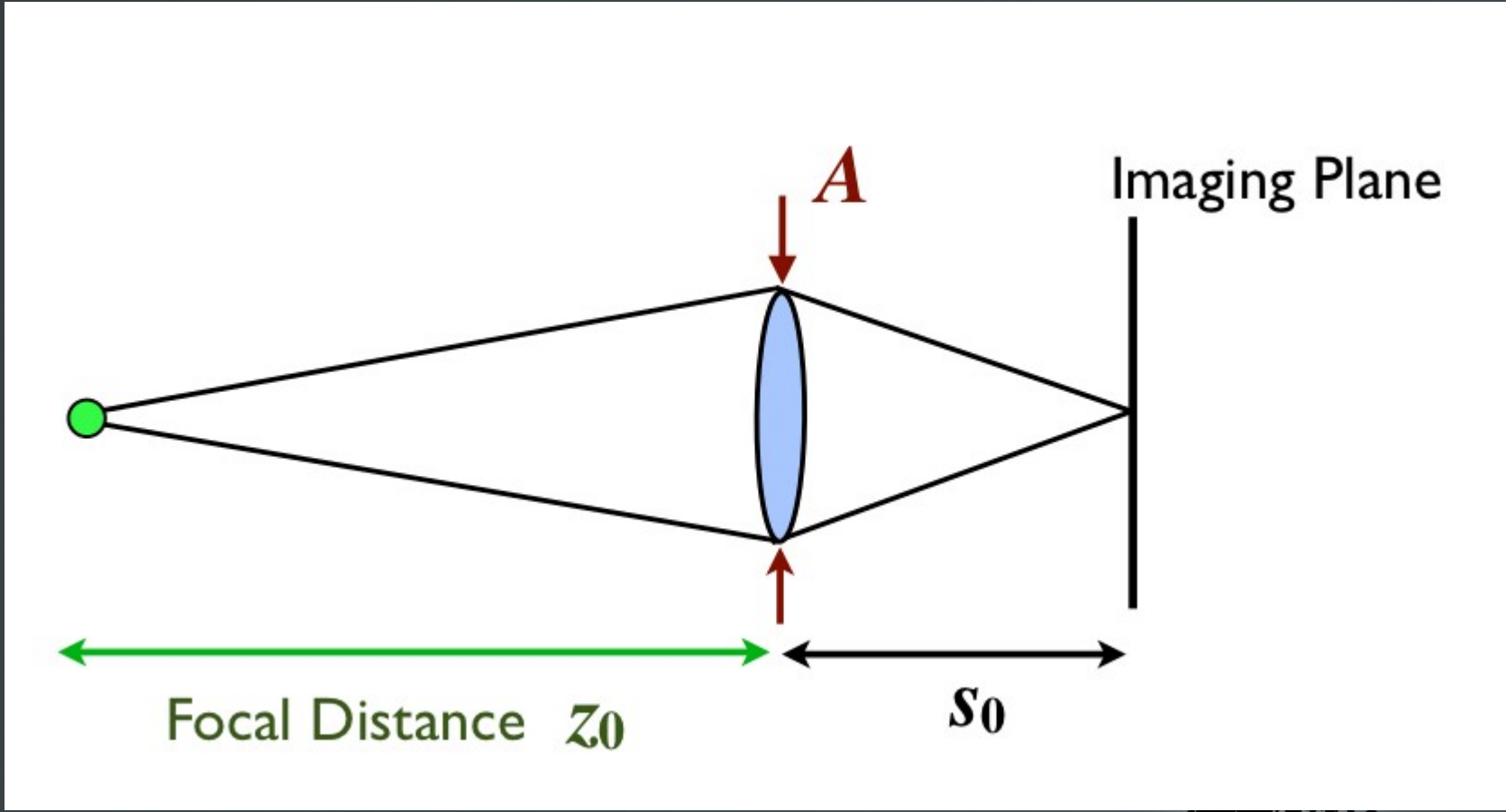
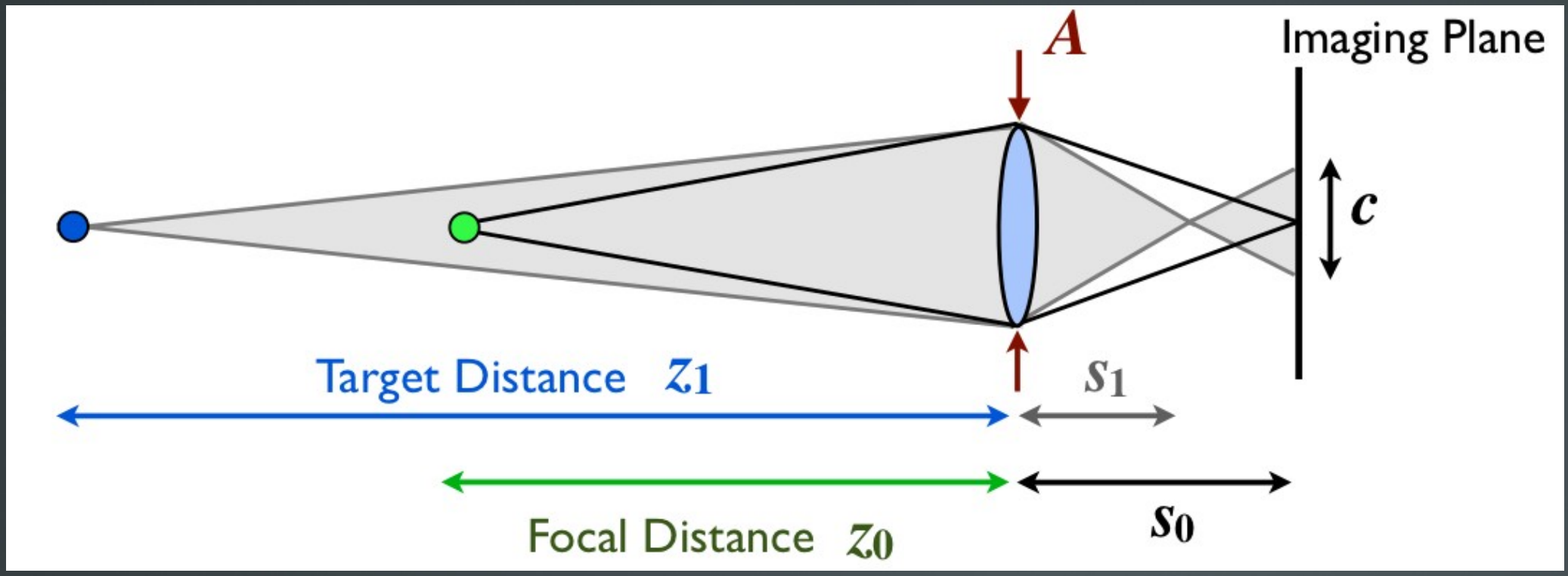


Basic Lens Optics: In focus



Basic Lens Optics: Out of Focus



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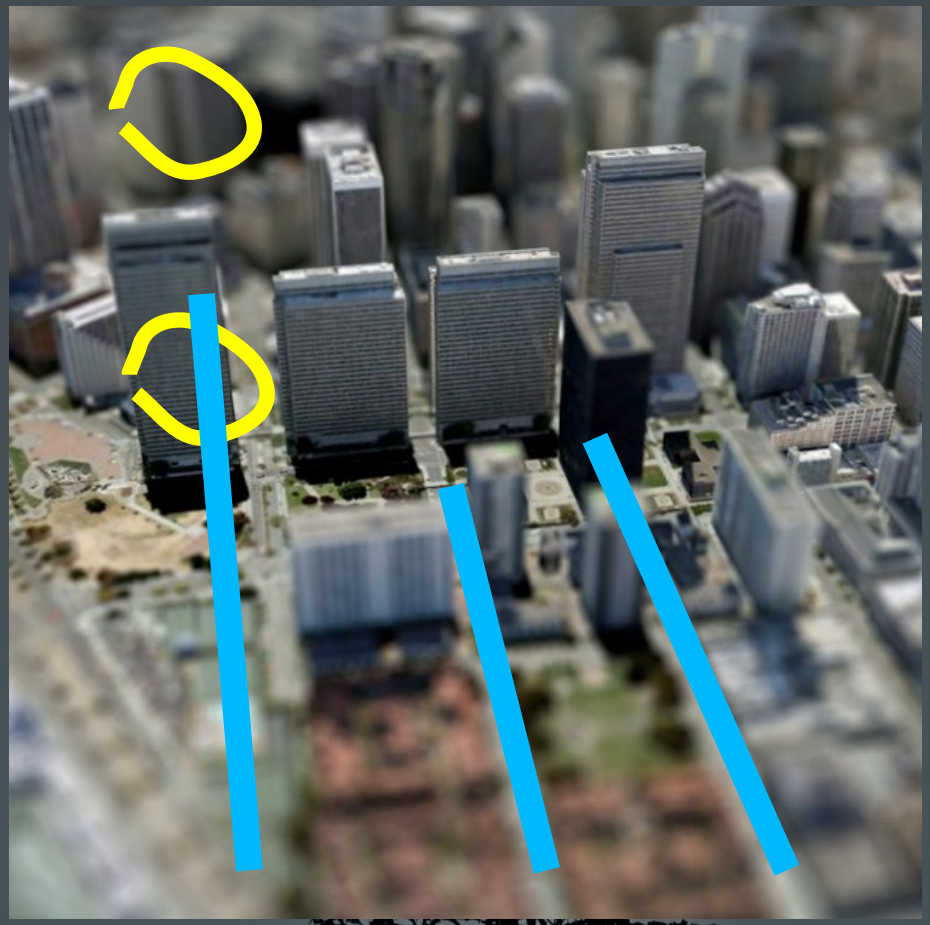

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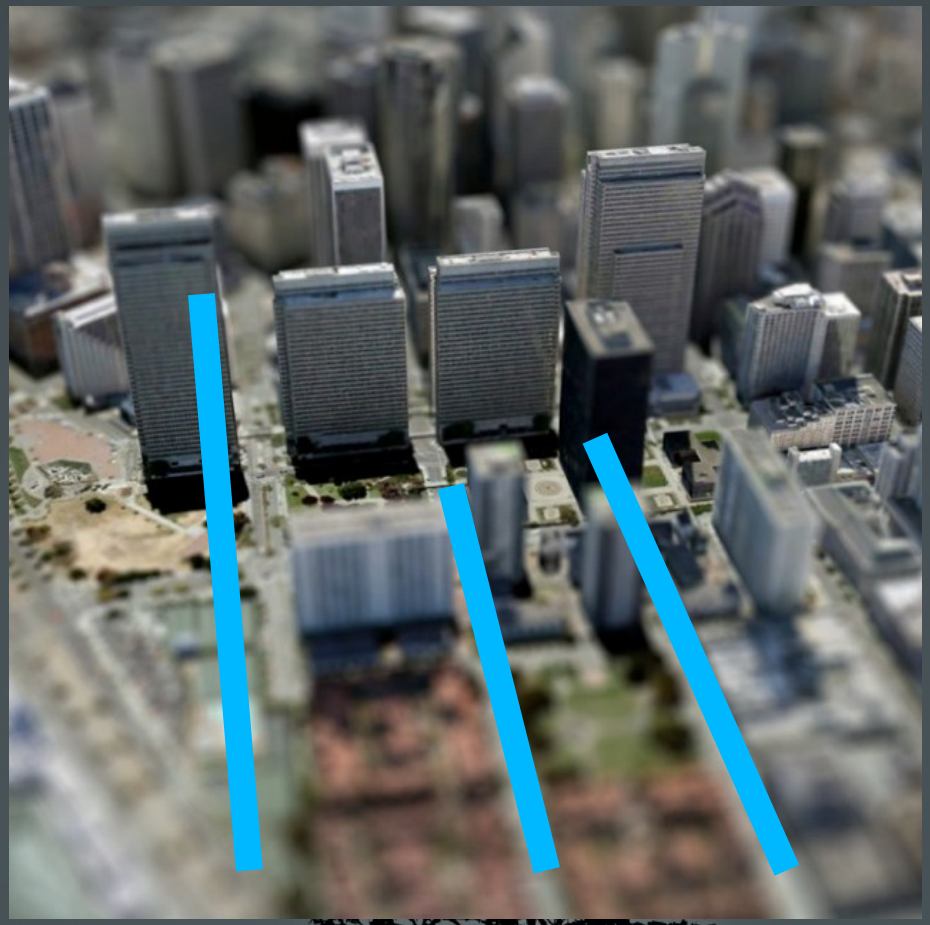


What does perspective tell us?

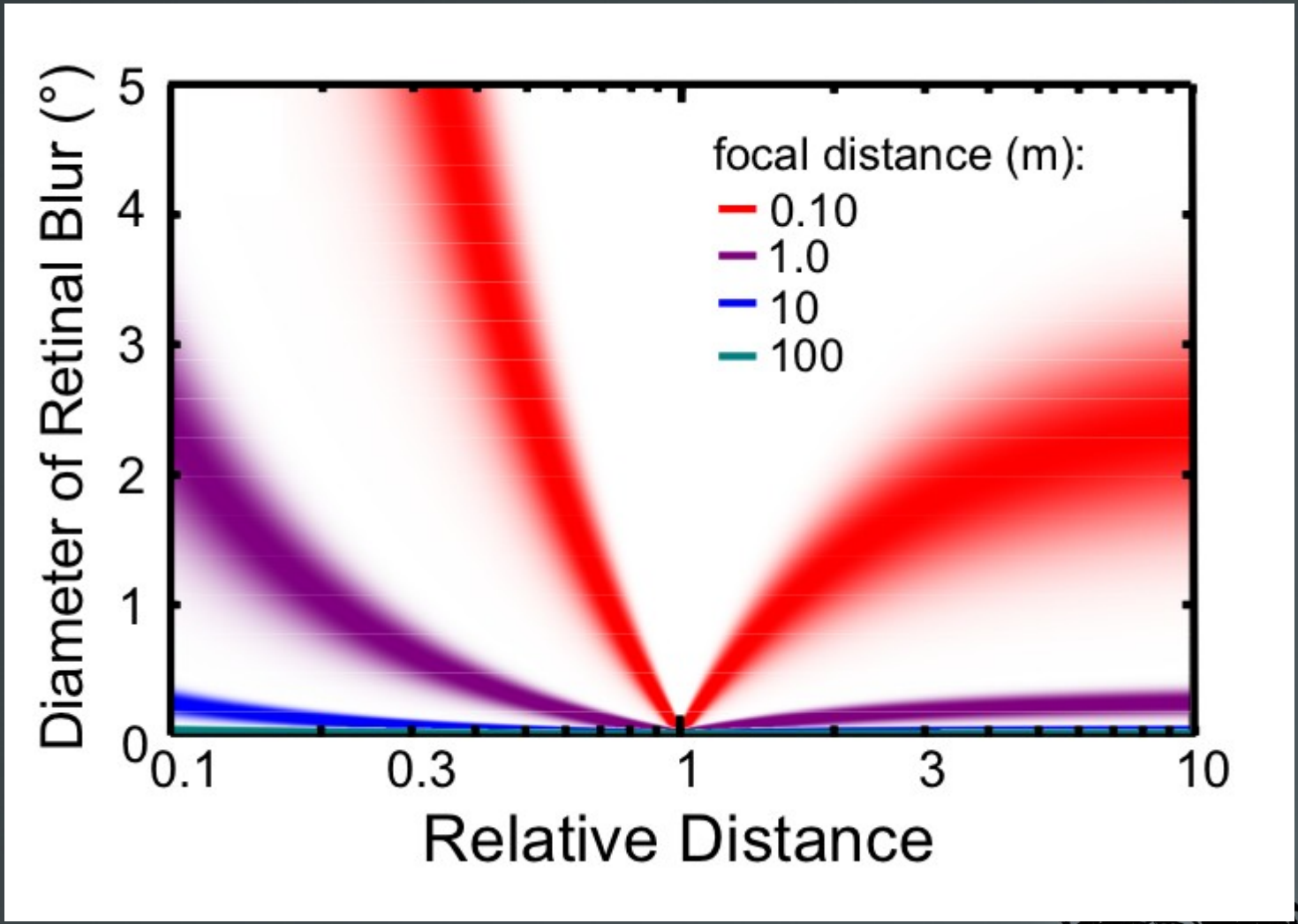


Image Creation

Knowing *relative distance* and *desired focal distance*,

how much to blur?

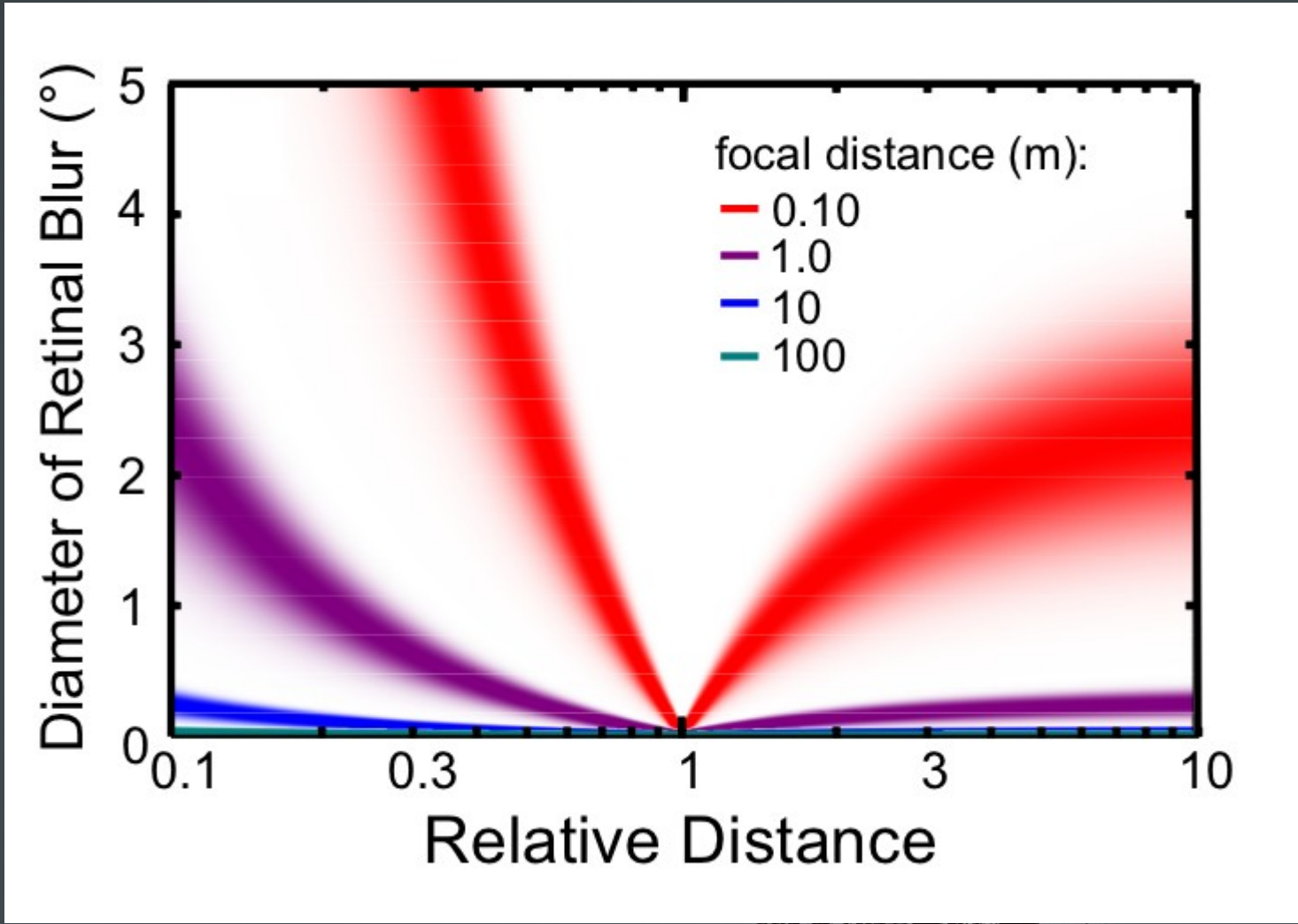
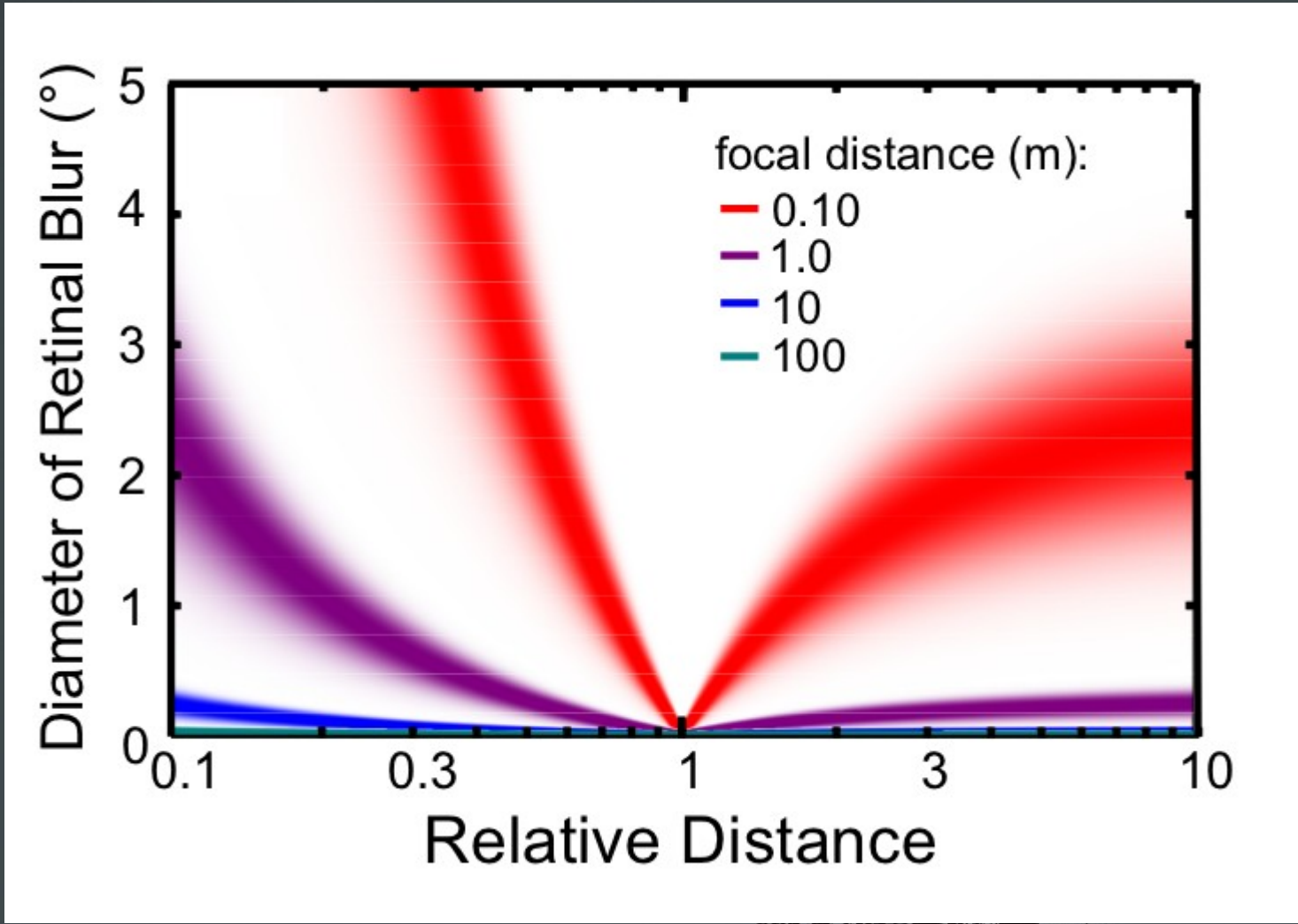


Image Pereption

Knowing *relative distance* and *blur diameter*,

What is the focal distance?



Formula

Blur amount is inversely proportianal to the relative distance

$$\hat{c}_1 = \left| A \frac{s_0}{\hat{z}_0} \left(1 - \frac{1}{d}\right) \right| = \left| A \frac{s_0}{m z_0} \left(1 - \frac{1}{d}\right) \right|$$

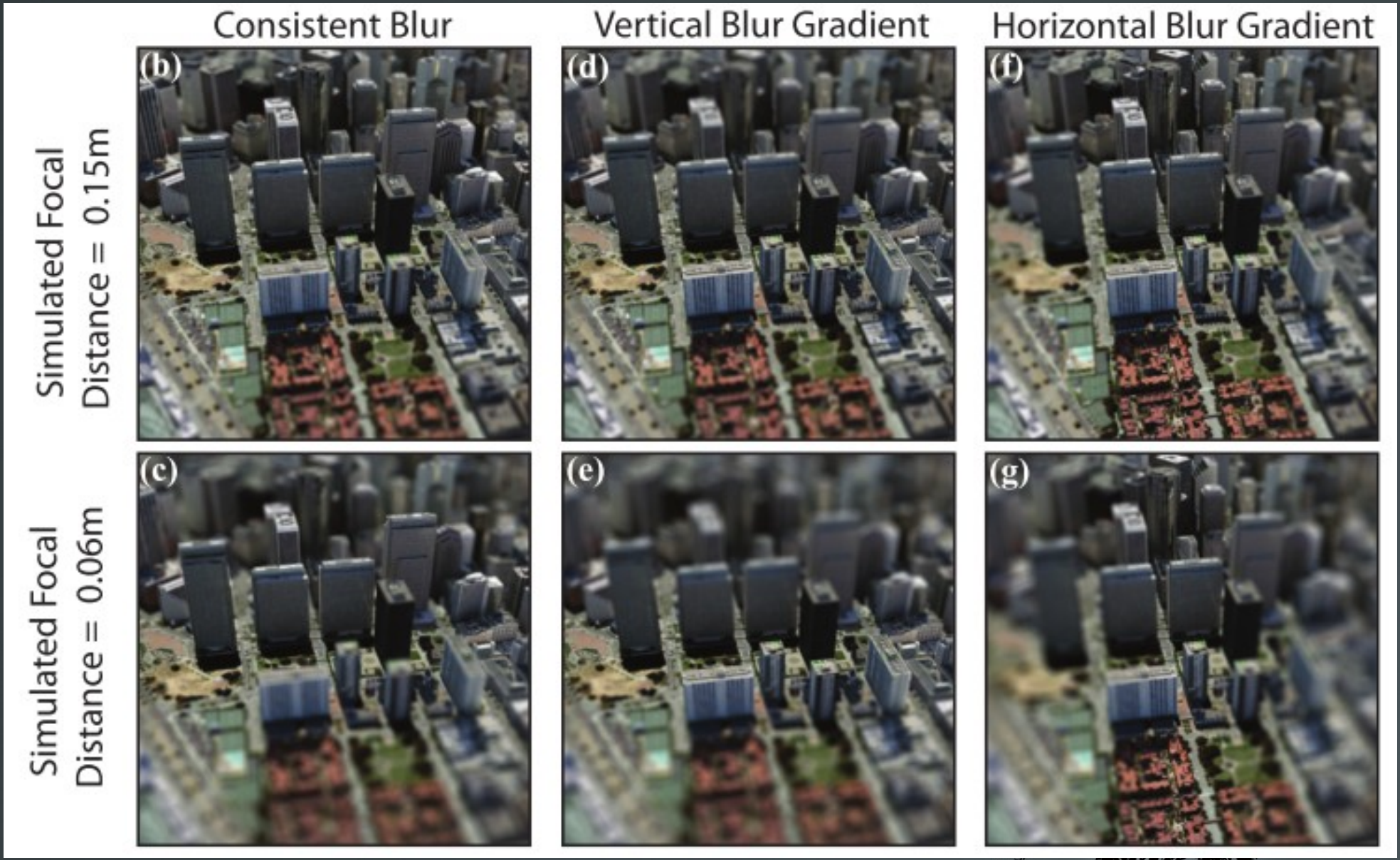
$$= \left| \left(\frac{A}{m}\right) \left(\frac{s_0}{z_0}\right) \left(1 - \frac{1}{d}\right) \right|$$

Example: ++blur

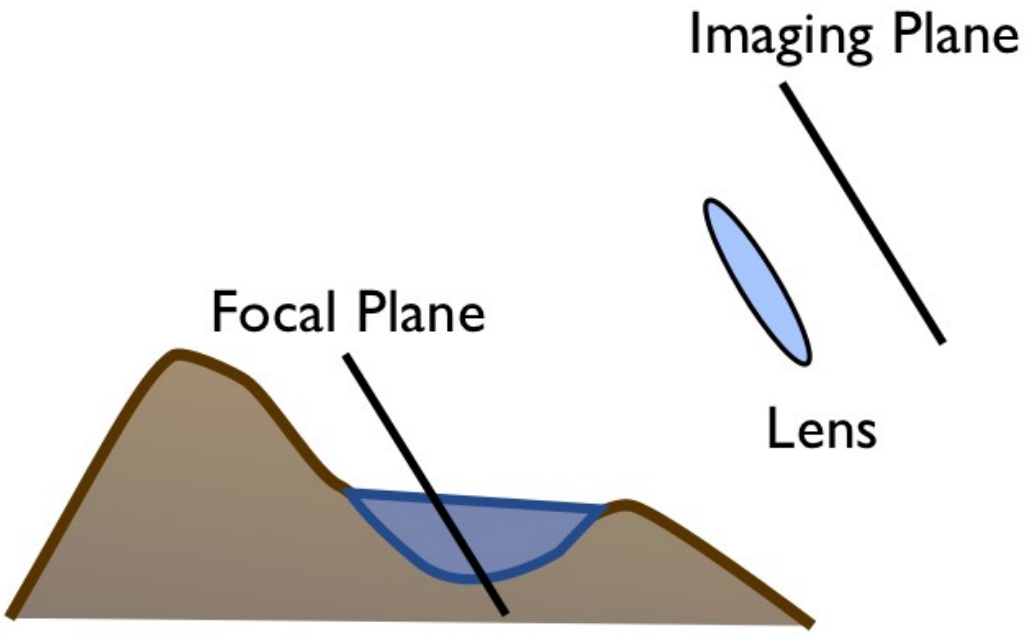
Examples that don't work

- Horizontal blur gradient
- Vertical blur gradient
- Linear blur / tilt-shift optics

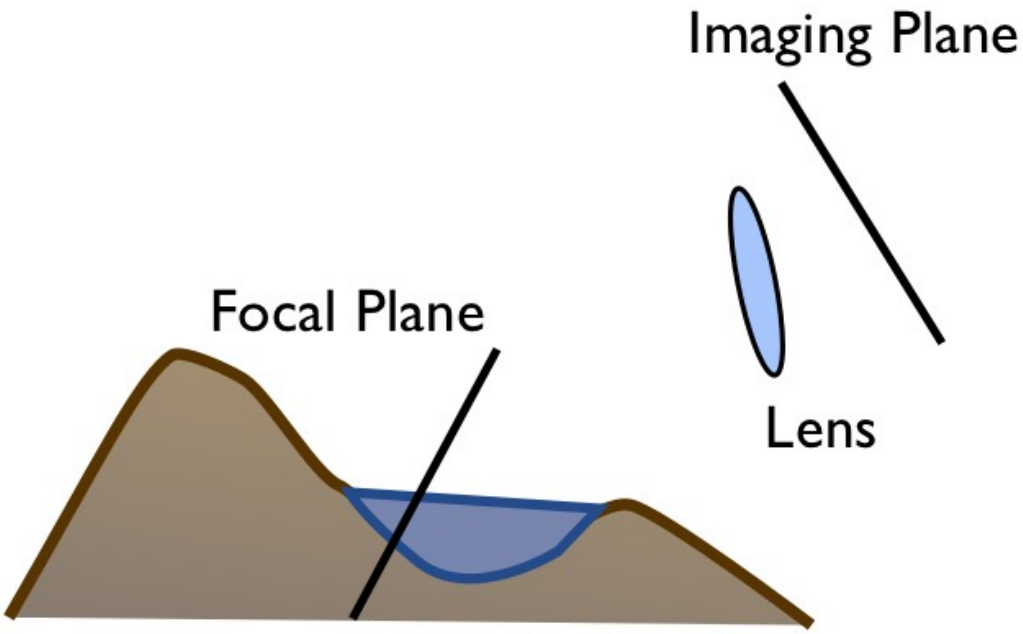
Horizontal/Vertical Blur



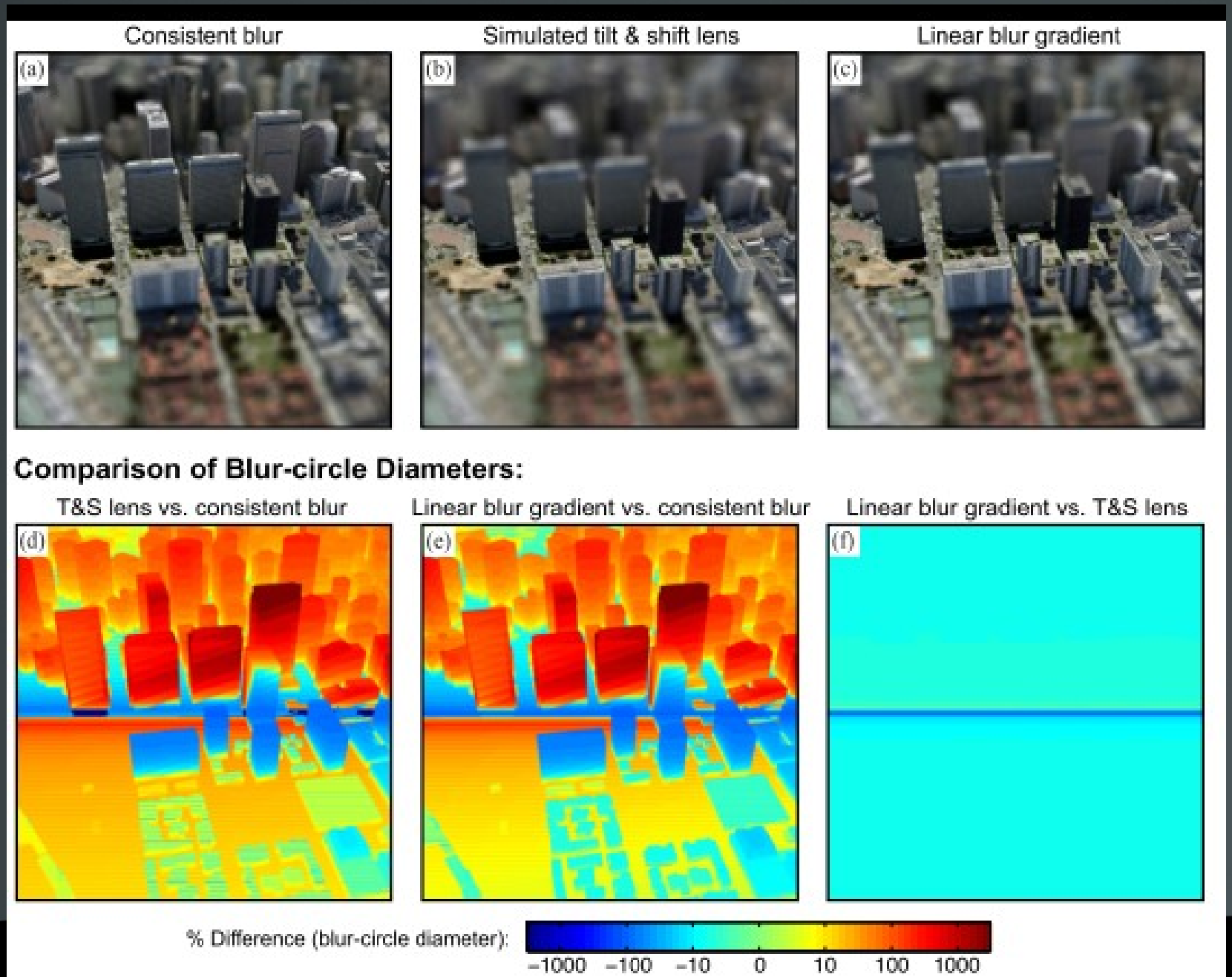
Normal Optics



Tilt-Shift Optics



Simulating tilt&shift



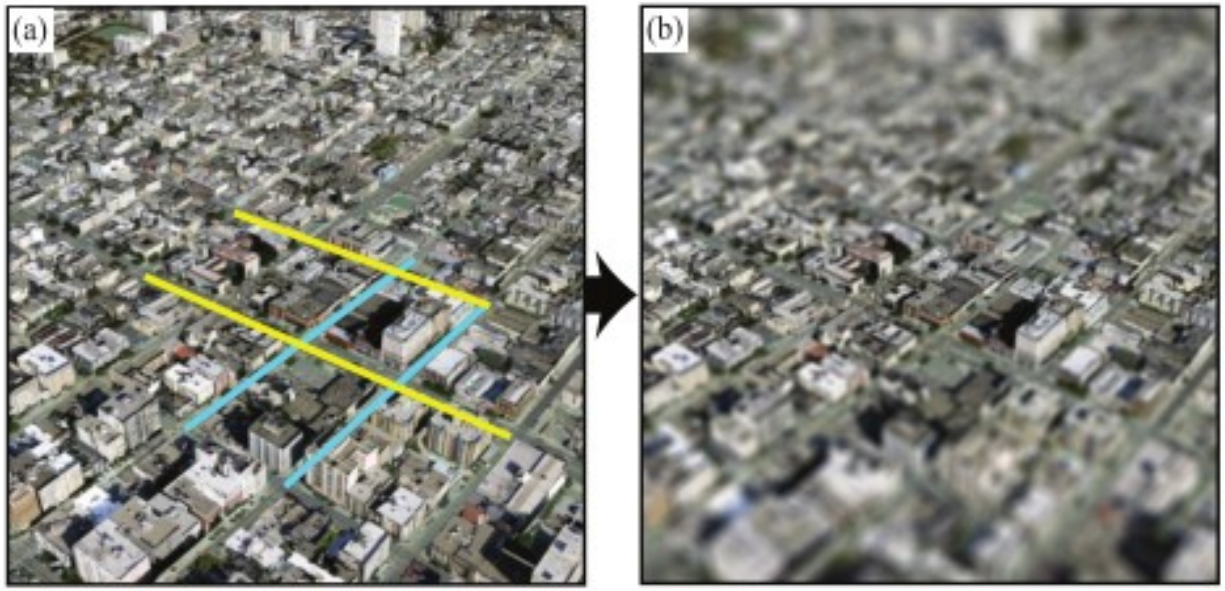
DISCUSSION TIME!

Taking height into account

Semi-Automated

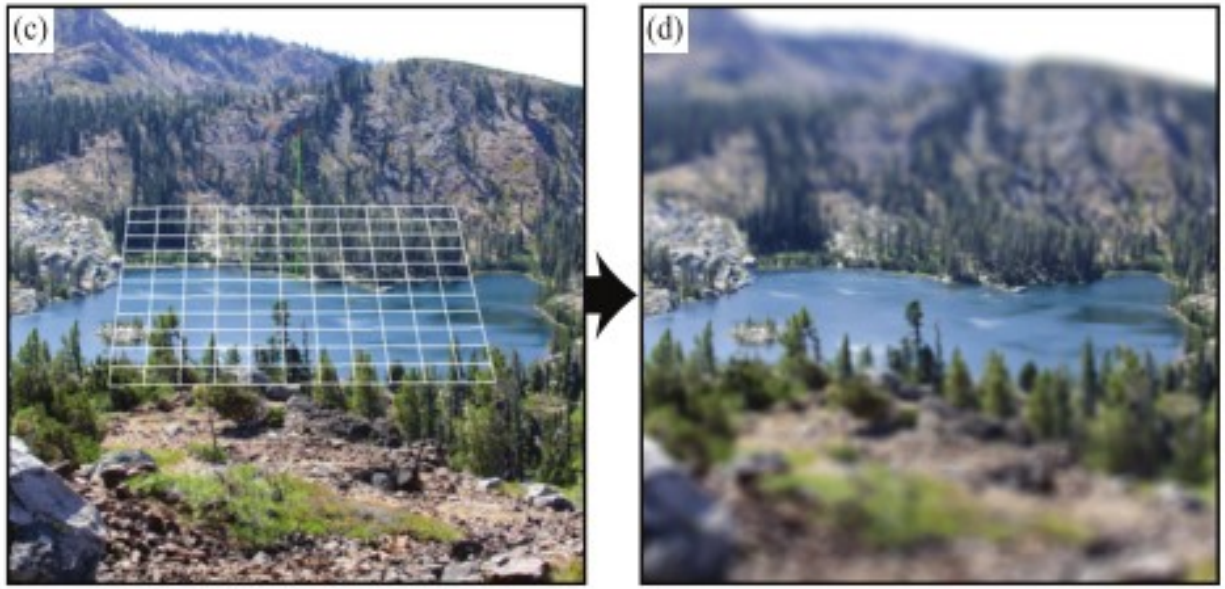
Slant-estimation Technique:
Parallel Lines

Intended Focal Distance:
0.06m



Slant-estimation Technique:
Manual Grid Alignment

Intended Focal Distance:
0.50m



In Black & White