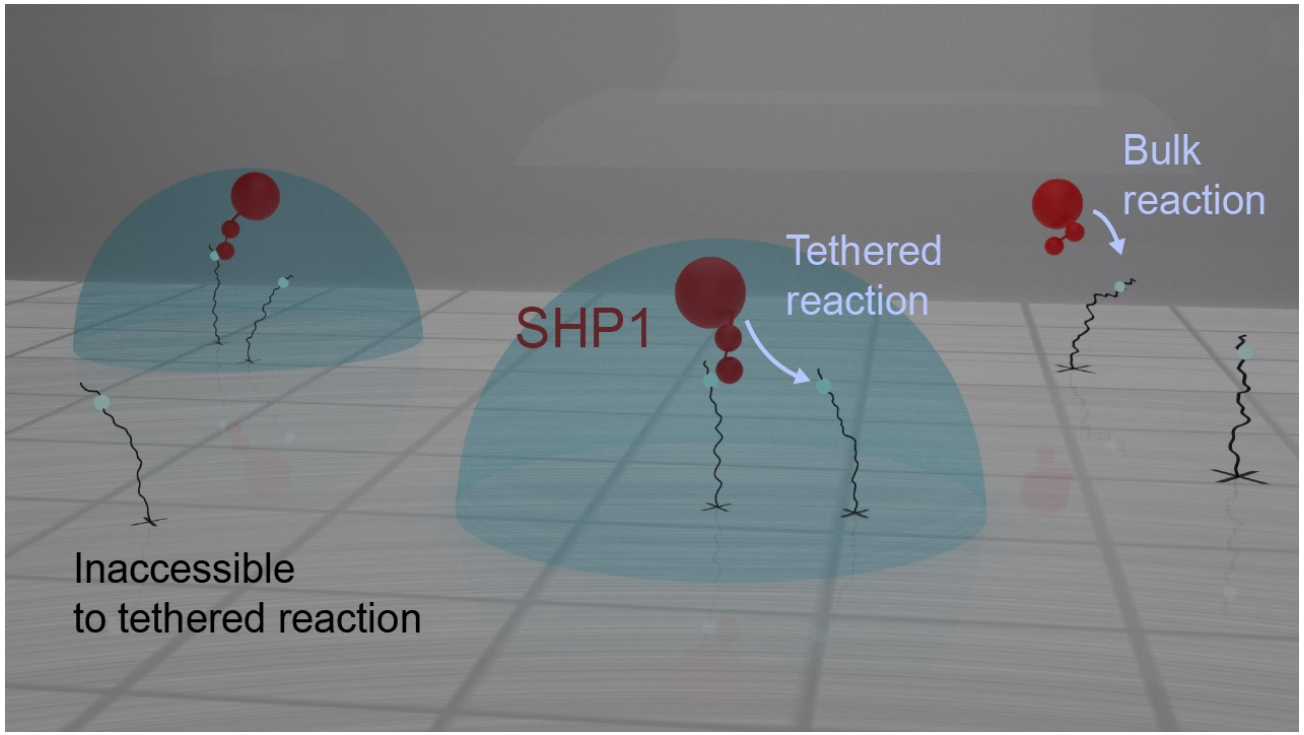
Blender Tutorial

Katie Lynch (UCI Math 2021)



OUTLINE

- Introduction
- Part 1
  - Basic Navigation
  - Object Mode
- Part 2
  - Edit Mode
  - Materials
- Part 3
  - Materials
  - Lighting
  - Rendering

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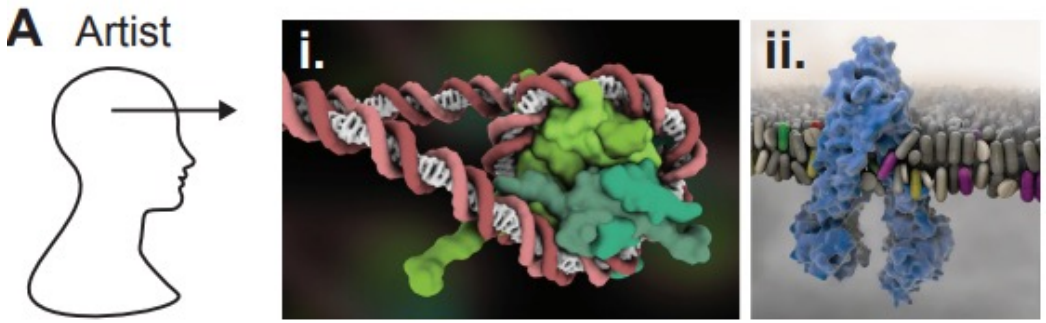
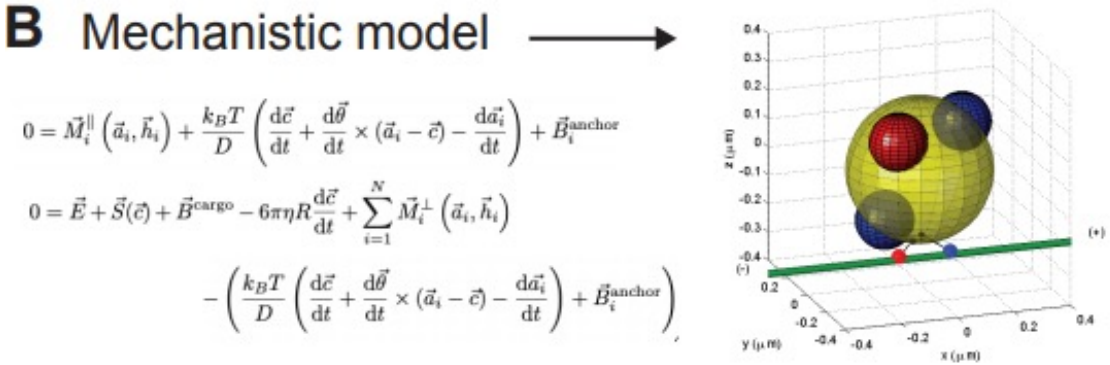
Scientific Visualization



Artistic model: visually appealing, but can be inaccurate



Mechanistic model: scientifically accurate, but not visually appealing

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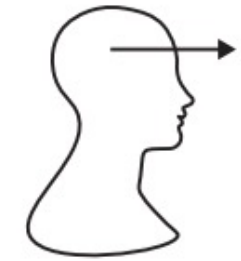
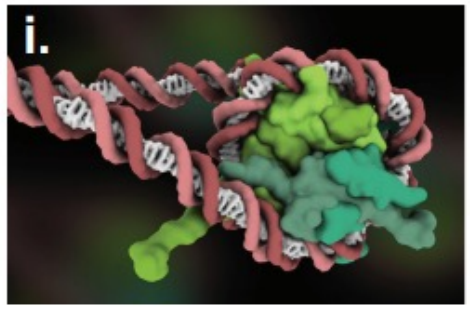
Scientific Visualization

A Artist



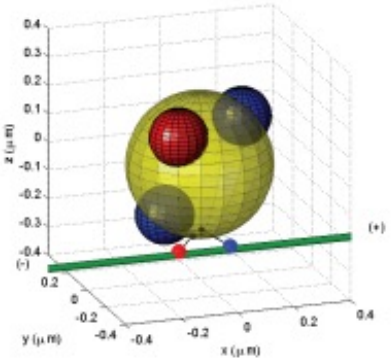


B Mechanistic model

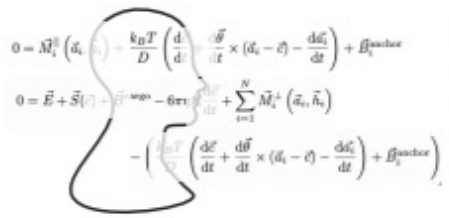
$$0 = \vec{M}_i^{\parallel}\left(\vec{a}_i, \vec{h}_i\right) + \frac{k_B T}{D}\left(\frac{\mathrm{d}\vec{c}}{\mathrm{d}t} + \frac{\mathrm{d}\vec{\theta}}{\mathrm{d}t} \times \left(\vec{a}_i - \vec{c}\right) - \frac{\mathrm{d}\vec{a}_i}{\mathrm{d}t}\right) + \vec{B}_i^{\text{anchor}}$$

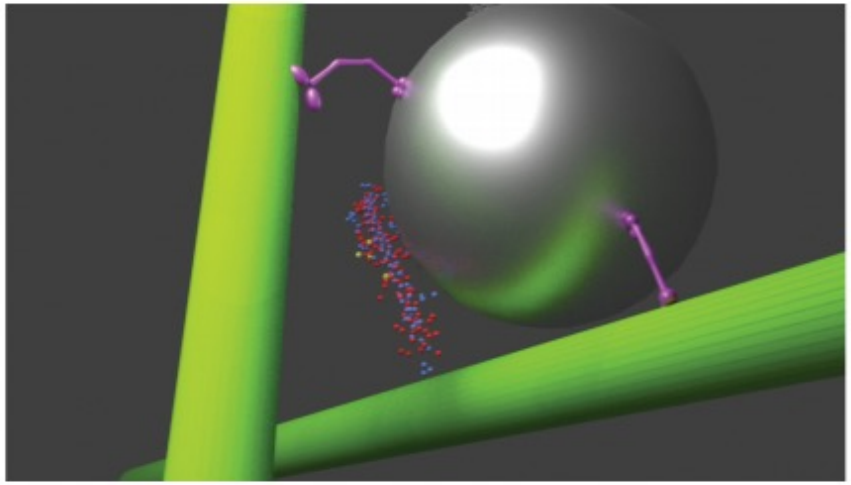
$$0 = \vec{E} + \vec{S}(\vec{c}) + \vec{B}^{\text{cargo}} - 6\pi\eta R\frac{\mathrm{d}\vec{c}}{\mathrm{d}t} + \sum_{i=1}^{N} \vec{M}_i^{\perp}\left(\vec{a}_i, \vec{h}_i\right)$$

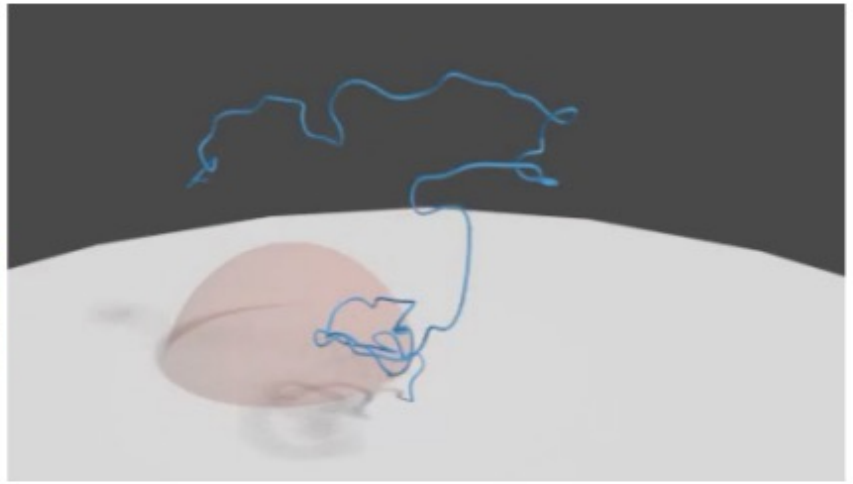
$$-\left(\frac{k_B T}{D}\left(\frac{\mathrm{d}\vec{c}}{\mathrm{d}t} + \frac{\mathrm{d}\vec{\theta}}{\mathrm{d}t} \times \left(\vec{a}_i - \vec{c}\right) - \frac{\mathrm{d}\vec{a}_i}{\mathrm{d}t}\right) + \vec{B}_i^{\text{anchor}}\right)$$



C Artist + Mechanistic model







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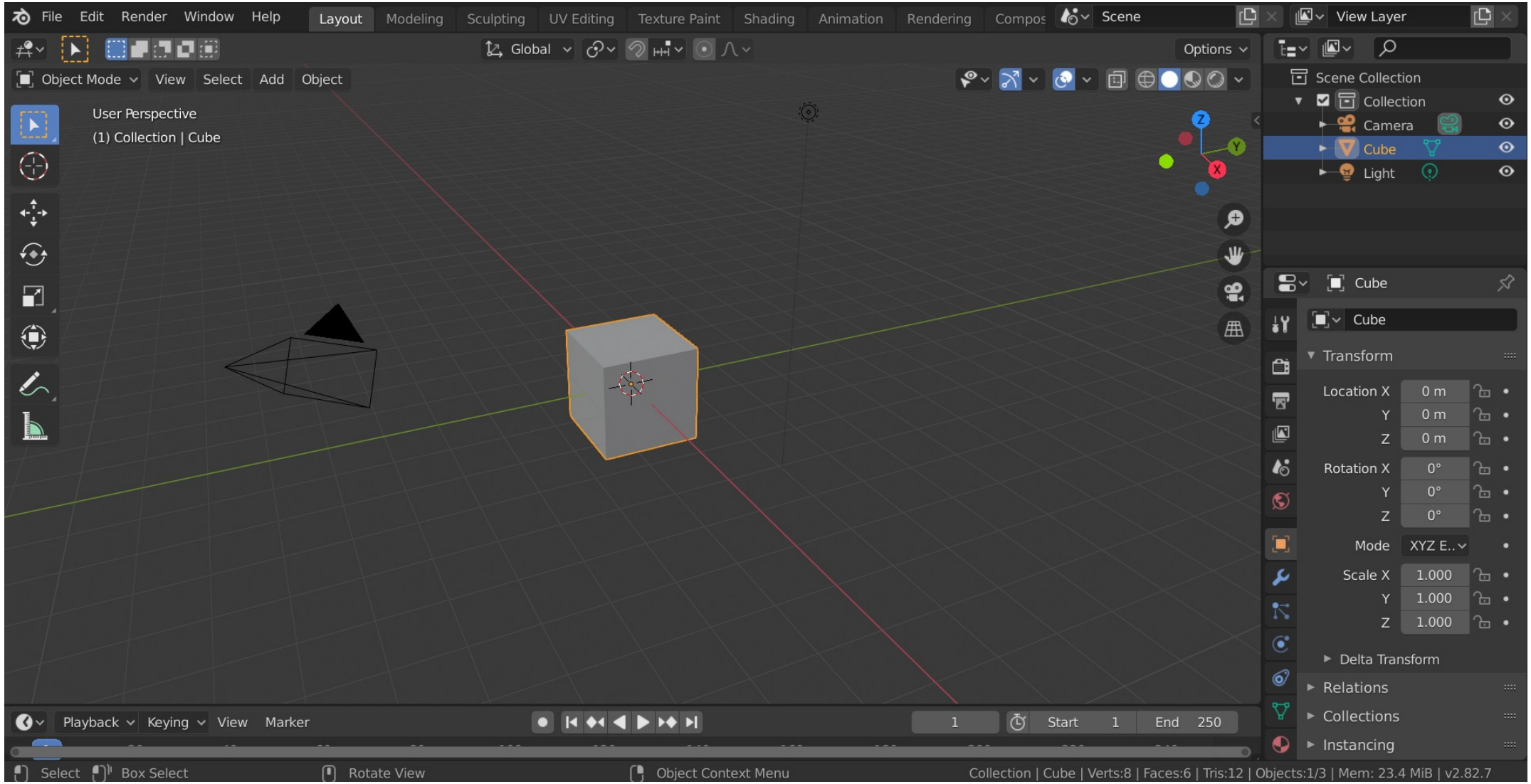
What is Blender?



Why Blender?

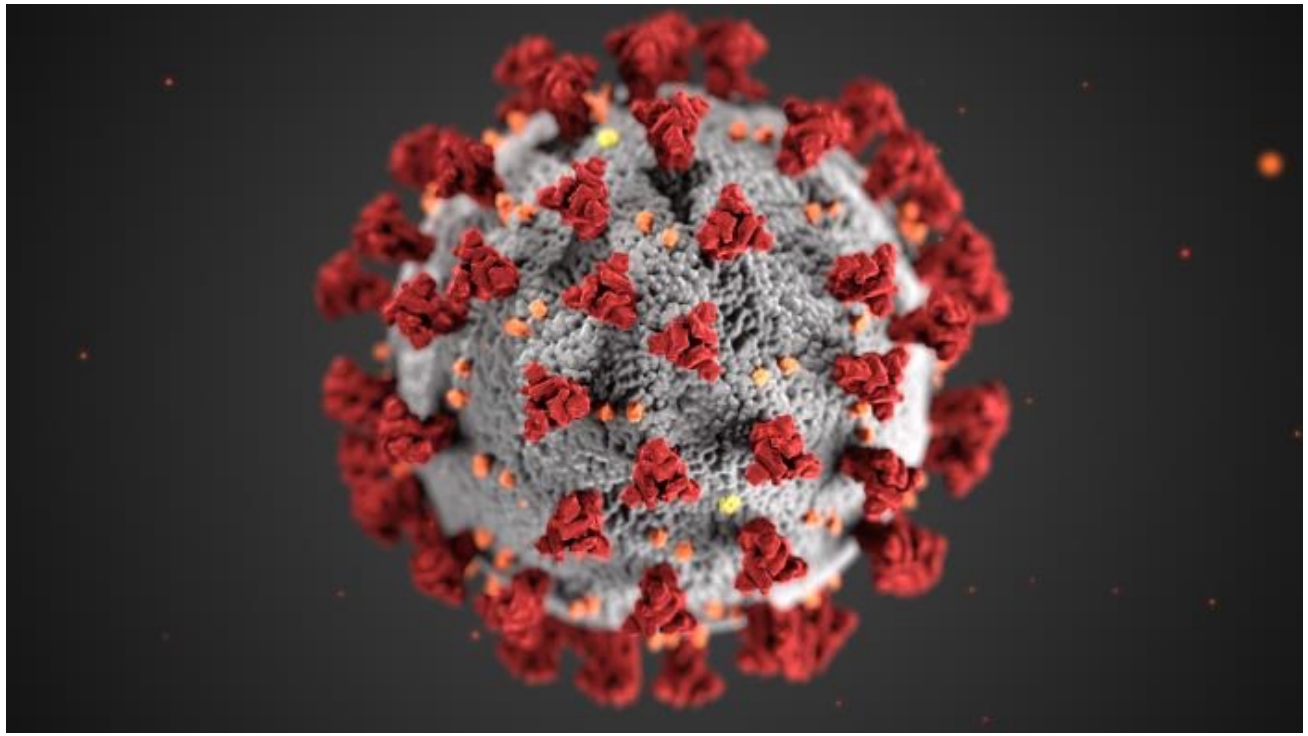
Pros

- Versatile
- Scientifically accurate
  - 3D environment
  - Python console
- Visually appealing
- Easily accessible
  - Free and open source
  - Lots of tutorials and documentation

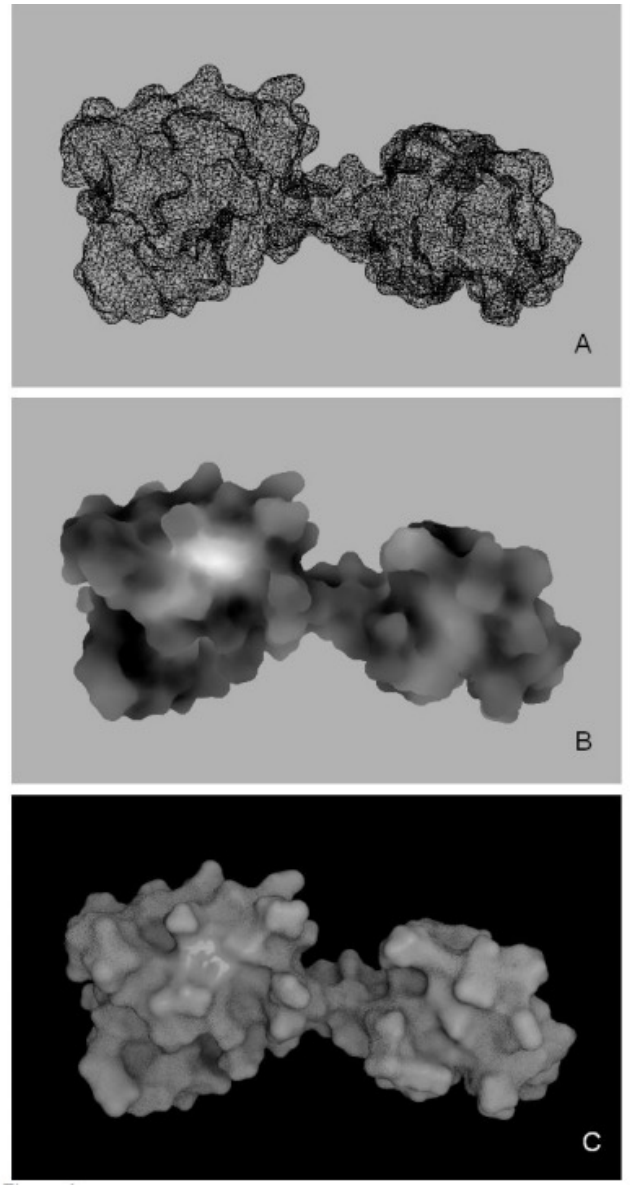
Cons

- Complicated
- Steep learning curve
- Rendering time

Blender and Science

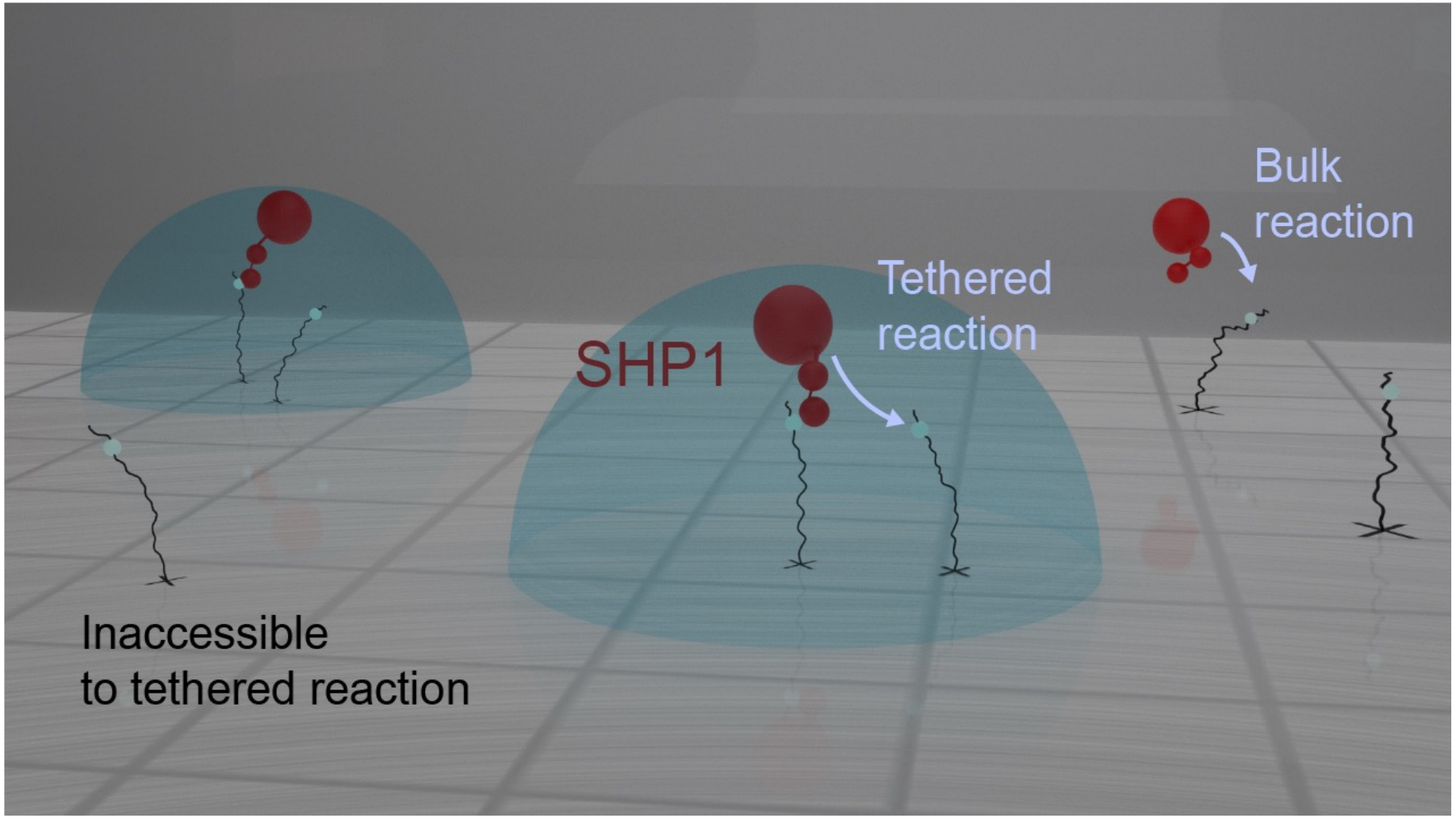


CDC / Alissa Eckert, MSMI; Dan Higgins, MAMS

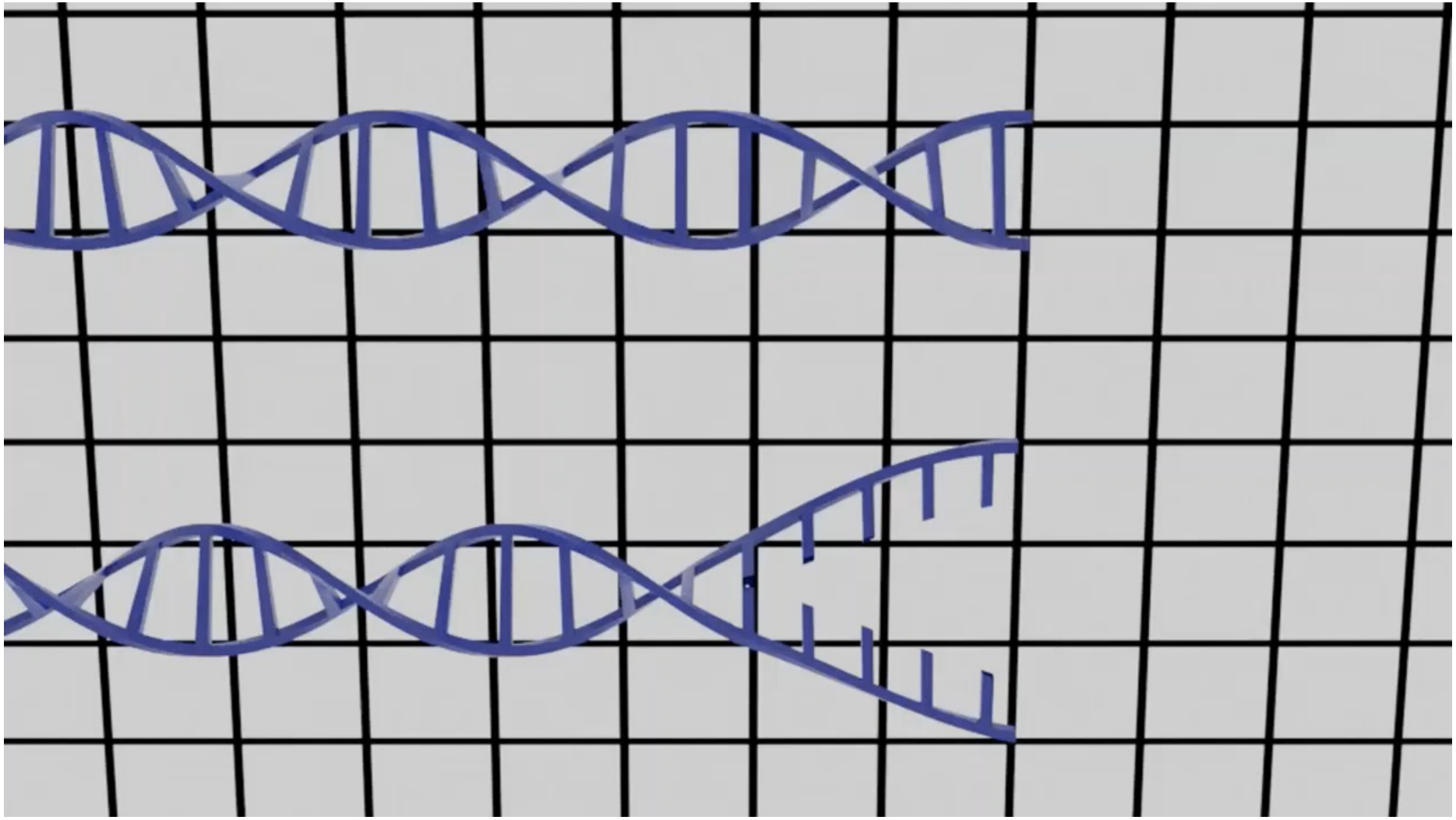


Andrei et al. 2012

Blender and Science: SHP1



Blender and Science: RAD51 and DNA Repair



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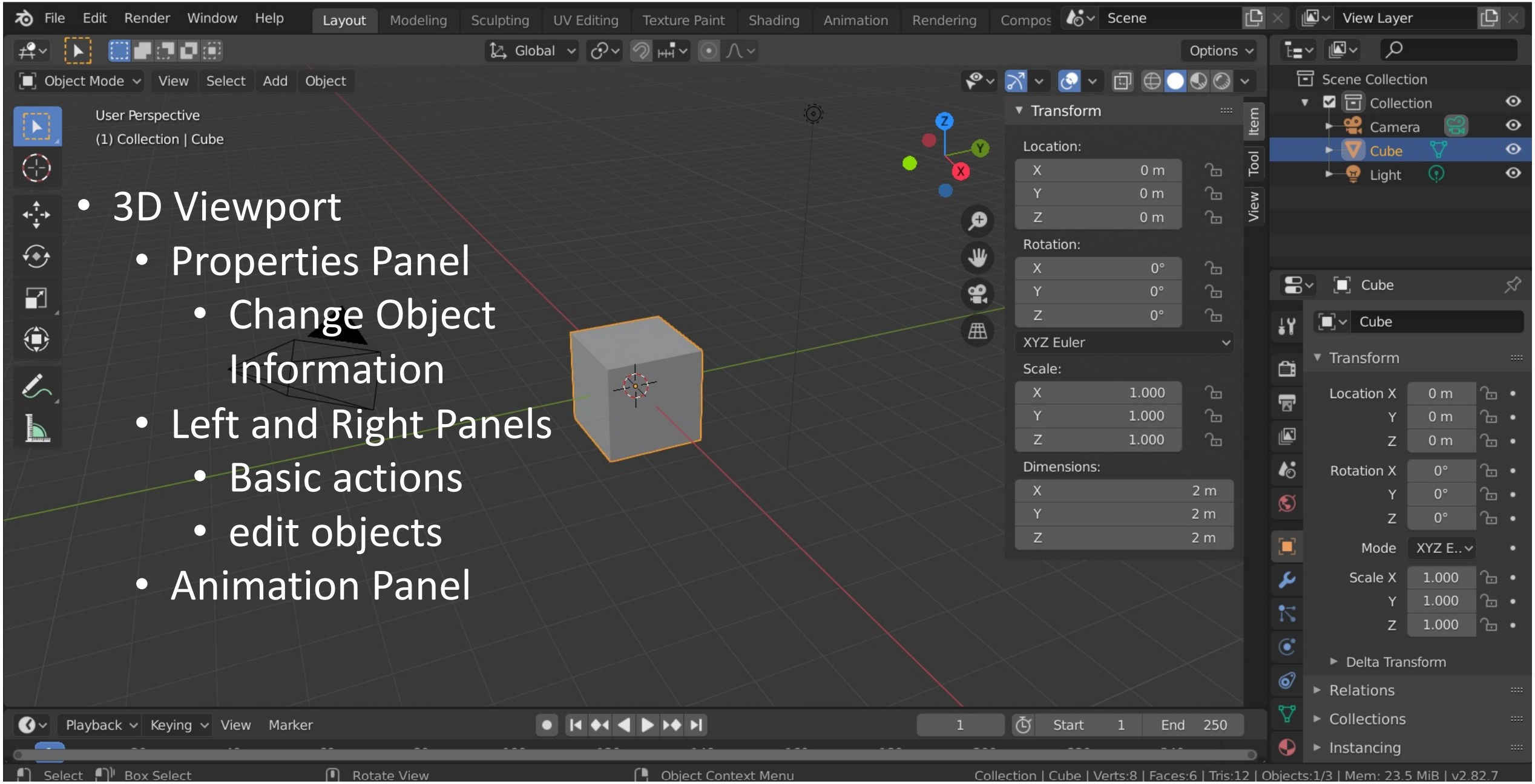


- 3D Viewport
  - Properties Panel
    - Change Object Information
  - Left and Right Panels
    - Basic actions
    - edit objects
  - Animation Panel

Moving Around

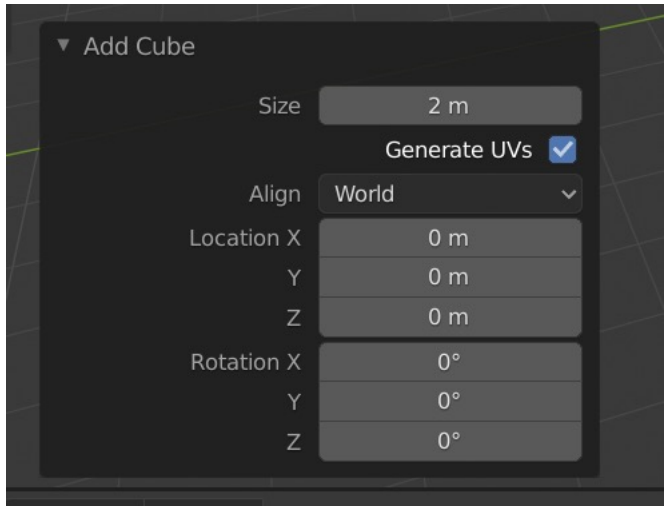
- Moving around
  - Middle mouse button: click to orbit, scroll to zoom
  - Shift + middle mouse button: pans

- Viewpoints
  - Numberpad 7: Top
  - Numberpad 1: Front
  - Numberpad 3: Side
  - Numberpad 0: Camera View

Hotkeys
R+middle mouse: pan view
Middle mouse: rotate view
Scroll middle mouse: zoom in/out
Numberpad 7: Top
Numberpad 1: Front
Numbmerpad 3: Side

Object Mode

- Delete object
- Create object
  - When first creating an object, you can edit it
- Changing object
  - Select object by right clicking on it
  - Scaling: S key
  - Moving: G key
  - Rotating: R key



Hotkeys
R+middle mouse: pan view
Middle mouse: rotate view
Scroll middle mouse: zoom in/out
Numberpad 7: Top
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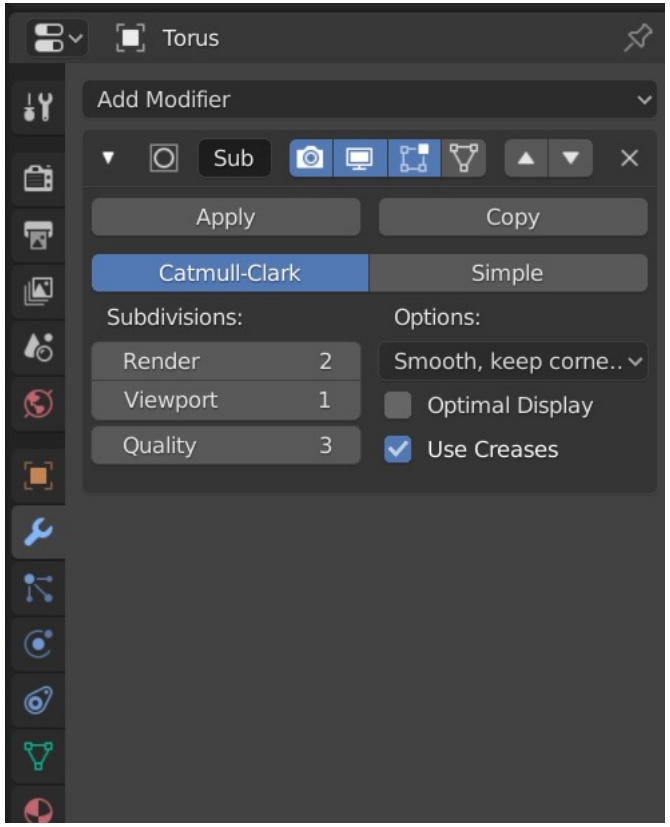
Numbmerpad 3: Side
X: Delete
Shift+a: create object
S: scale object
G: move object
R: rotate object
T: toolbar
N: right hand toolbar
Ctrl+z: undo

Object Mode

- Always create an object with low resolution
  - This becomes a problem later when rendering
- Use modifiers instead
  - Subdivision modifier
  - Shade smooth



Small Groups

- Delete cube
- Create a donuts (torus)
- Create a table (plane)
- Position objects

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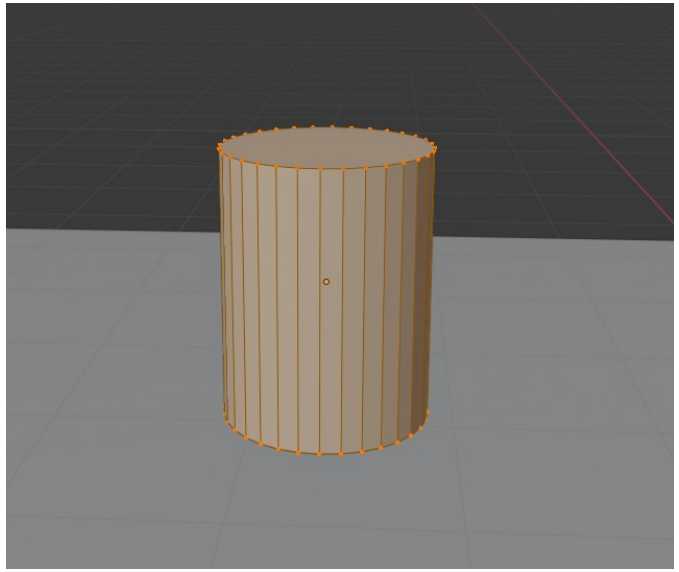
Edit Mode

- Always start with an object close to the desired end shape
- Allows manipulation of object shapes
- Can move (G) and rotate (R) vertices, edges, and planes



Hotkeys in Edit Mode
Tab: enter / exit edit mode
O: proportional edit
Shift: select multiple
B: box select
Alt+left mouse: select entire row/column
Ctrl+R: create loop
i: insert
E: extrude

Small Groups

- Create a cup
  - Start with a cylinder
  - Use edit mode to model

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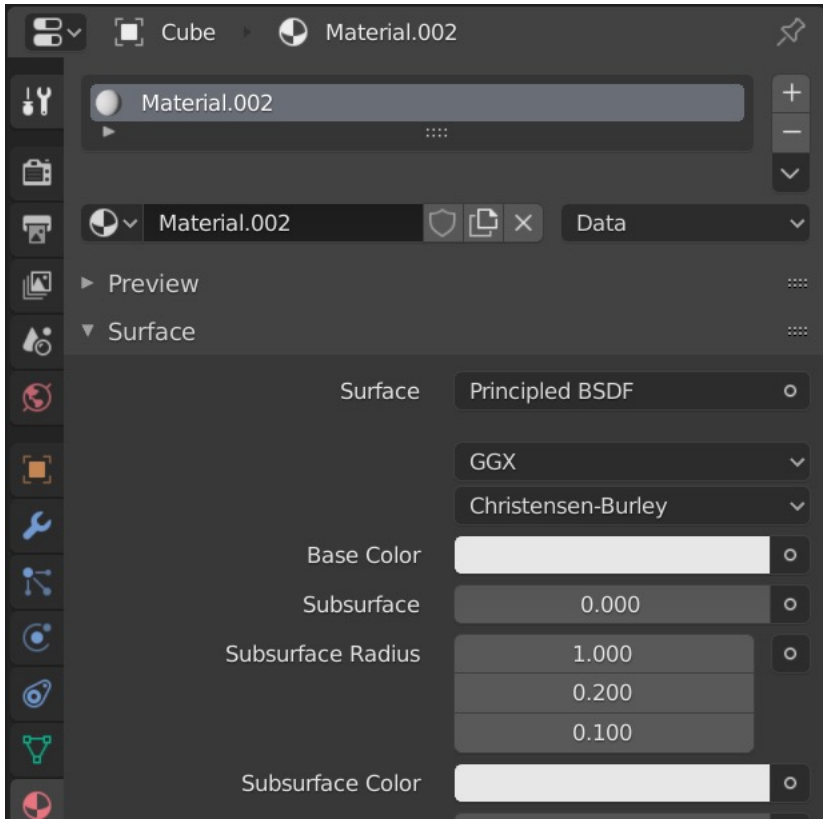
Materials and Modifiers

- Use materials tab on right hand side to add a material
  - Basic options include color
- Use modifiers tab on right hand side to smooth the object
  - Subdivision surface adds vertices
    - Use a low number in viewport
  - Many other useful modifiers
- Other options: shade smooth



Lighting

- Four types of lights
  - Point: lighting in all directions
  - Sun: only angle matters in positioning
  - Spot lamp: limited area, allows focus on one object
  - Area lamp: similar to spot, but wider focus

- Changing the background to a lighter color contributes to lighting
  - Never use as primary light source
  - Washes out the scene

- Generally want one primary light source for a scene

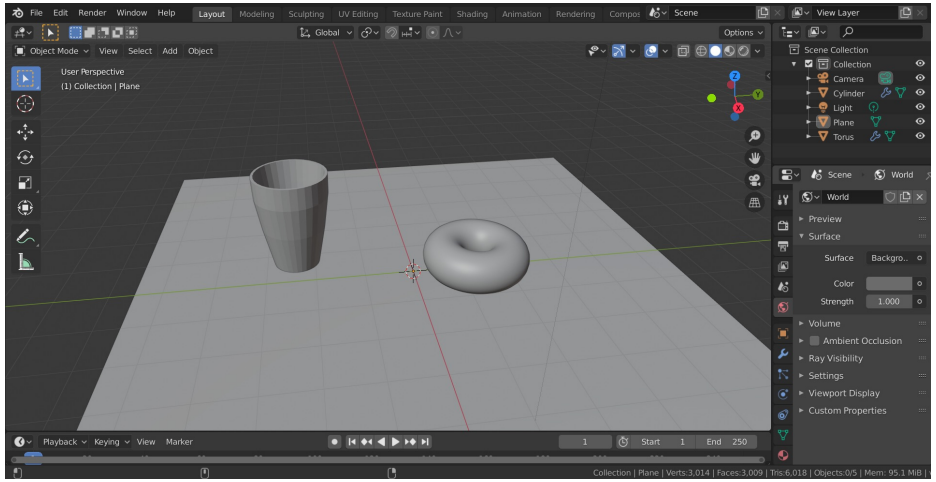
Rendering

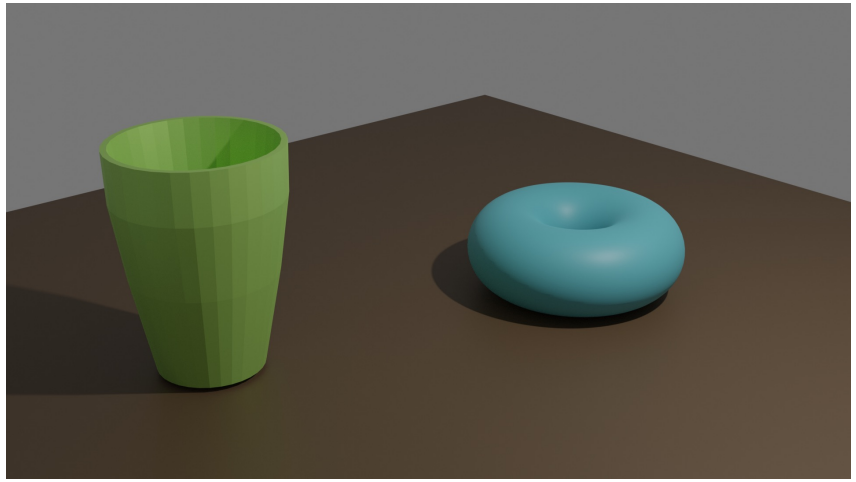
Getting the final product

- Can render still image (.png)
- Or animated movie (.mkv)

What affects rendering time?

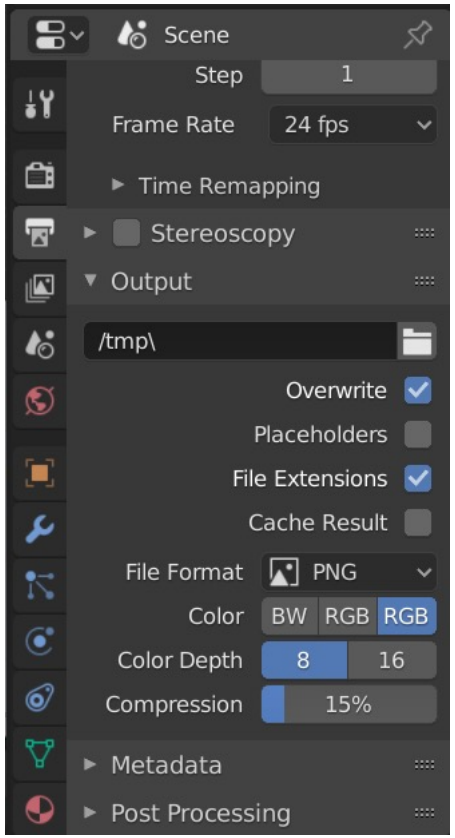
- GPU vs CPU
- Scene complexity
- Quality of output
  - Tile size
  - Resolution of image

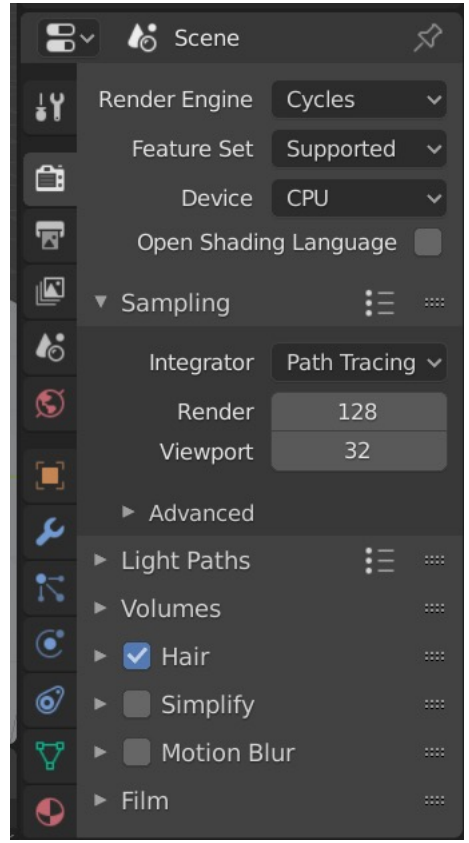




How to Render

- Assuming camera is in the right position, you will want to check the following options before rendering:
  - Rendering properties
    - Rendering engine (cycles)
    - GPU vs. CPU
  - Output properties
    - Where image will output
    - What type of image (png)
    - Resolution





Small Groups

- Change to cycles rendering engine
- Use subdivision surface modifier
- Use “shade smooth” for donut
- Add materials for donut, cup, and table

- Render later if you want to,

as it will make your zoom call lag

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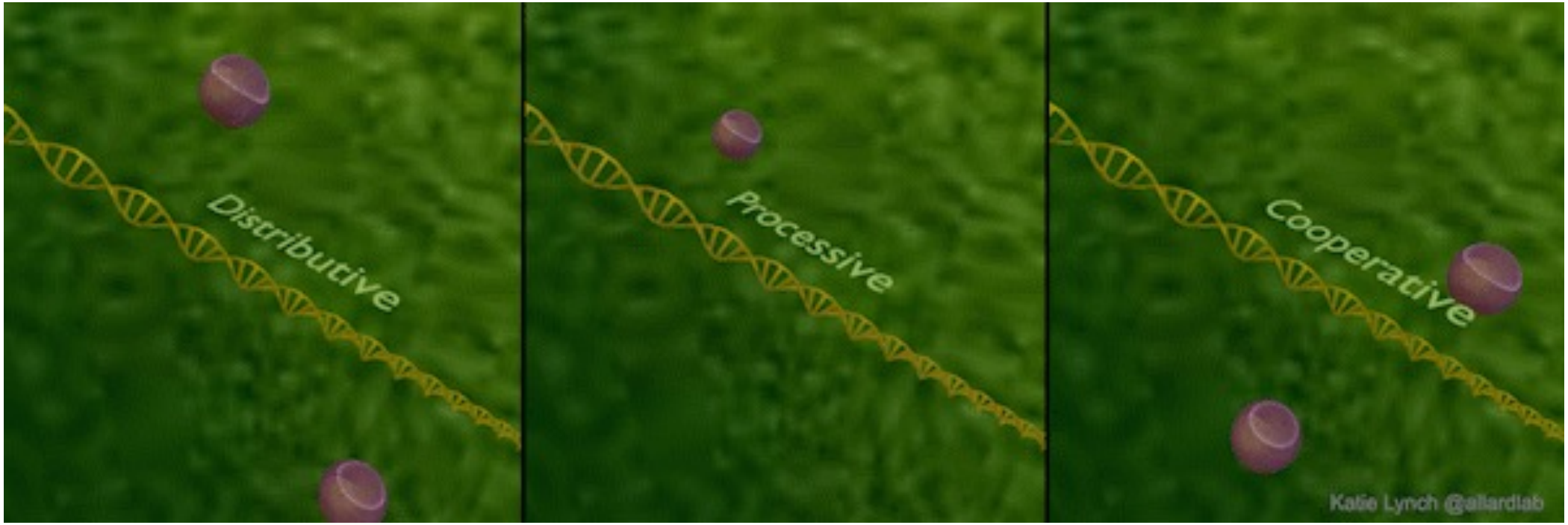
Rendering Instructions

- Check the following options:

  Rendering properties
    Rendering engine (cycles)
    GPU vs. CPU (CPU)
  Output properties
    Where image will output
    What type of image (png)
    Resolution
- In the top menu, click render and then render image

- Share in the slack channel!

A Final Example: DNA Methylation



Thanks for listening!