Welcome to the PhD course in Scientific Visualization and Presentation in 3D

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Why a course in 3D modelling?

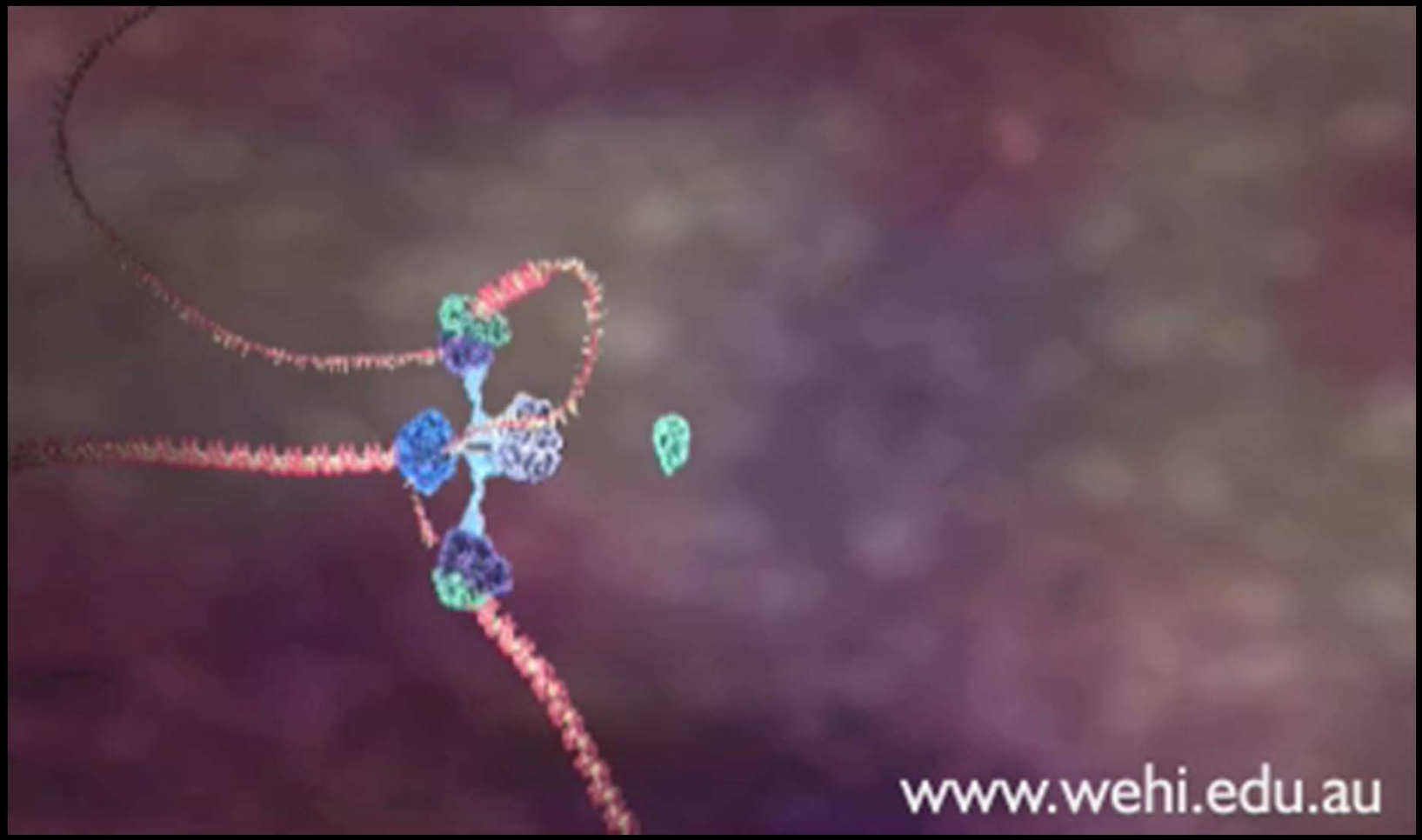
- Making your research easy to understand
  - Animations to explain difficult processes.
  - 3D renders to visualize difficult geometrical processes *without having an art degree.*
  - If people don't understand your science, they will not cite you, nor promote it.
- Making your research presentations look good
  - "Good looking science" makes the headlines more often -> More citations.
- Design/Hypothesis Tools for your research

Data Visualization ⟷ Communication

Presentations
Papers
Working models
Hypotheses tools

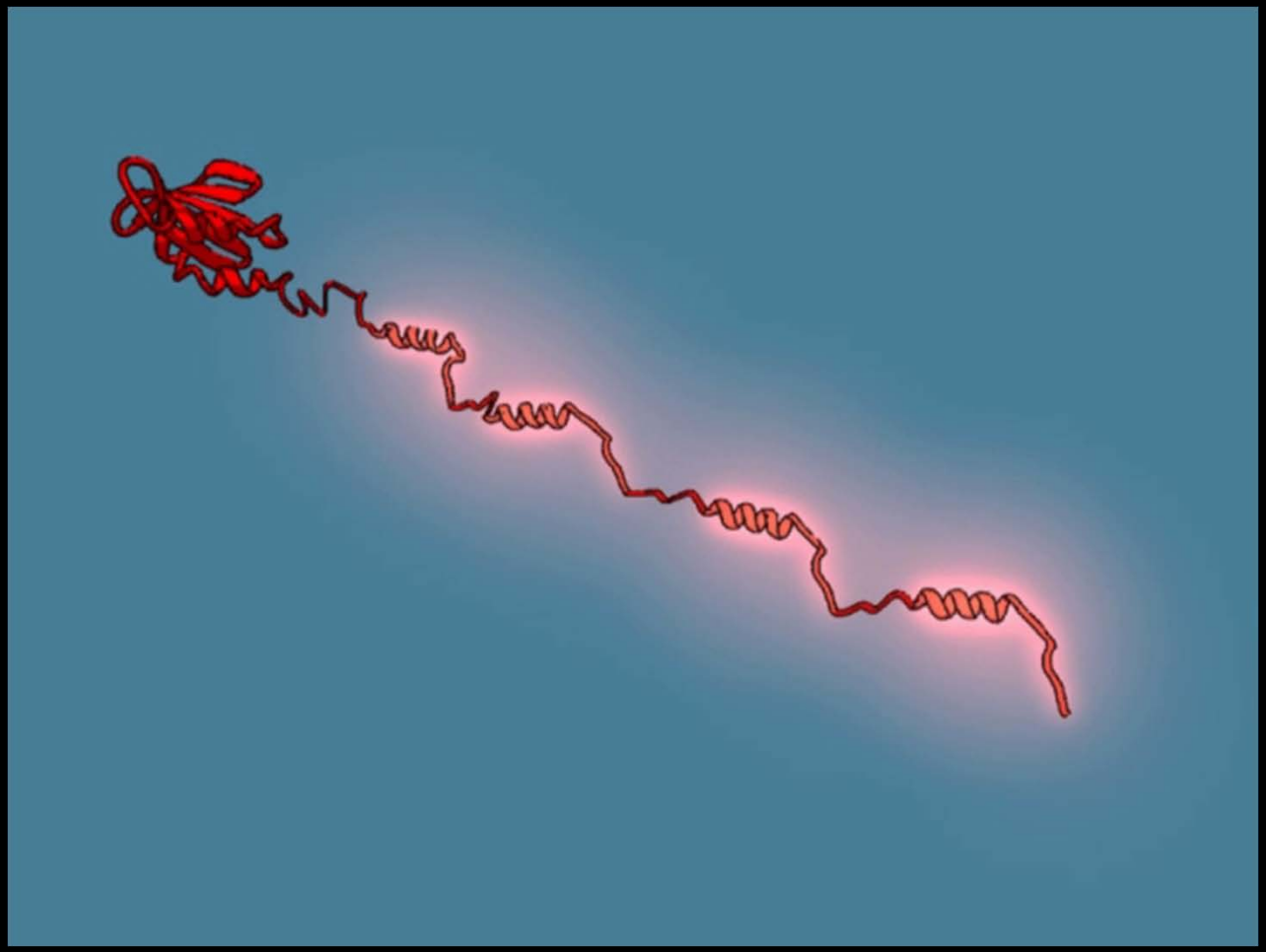
Presentations
Papers

Inspiration



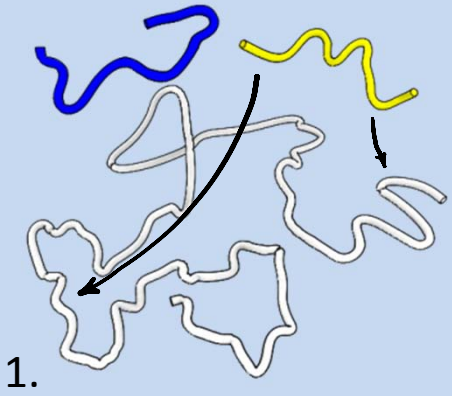
Drew Barry, Walter and Eliza Hall Institute of Medical Research (WEHI), Australia

Inspiration

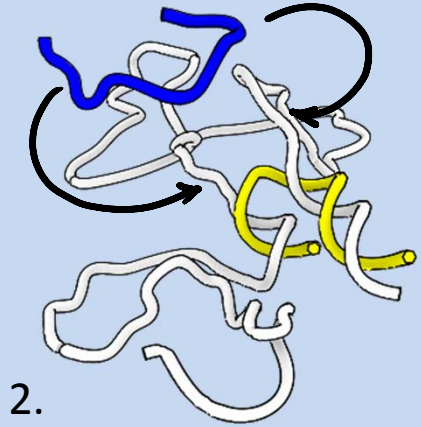


Janet Iwasa, Harvard Medical School, Boston, MA - USA

Inspiration



1.



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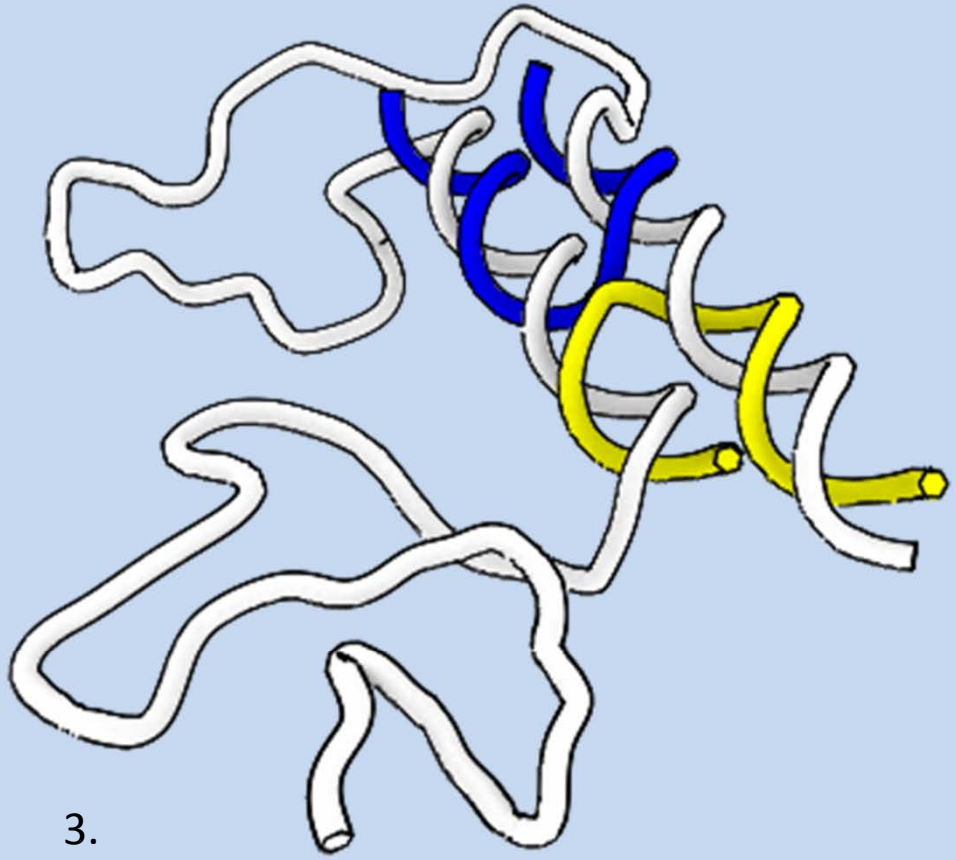
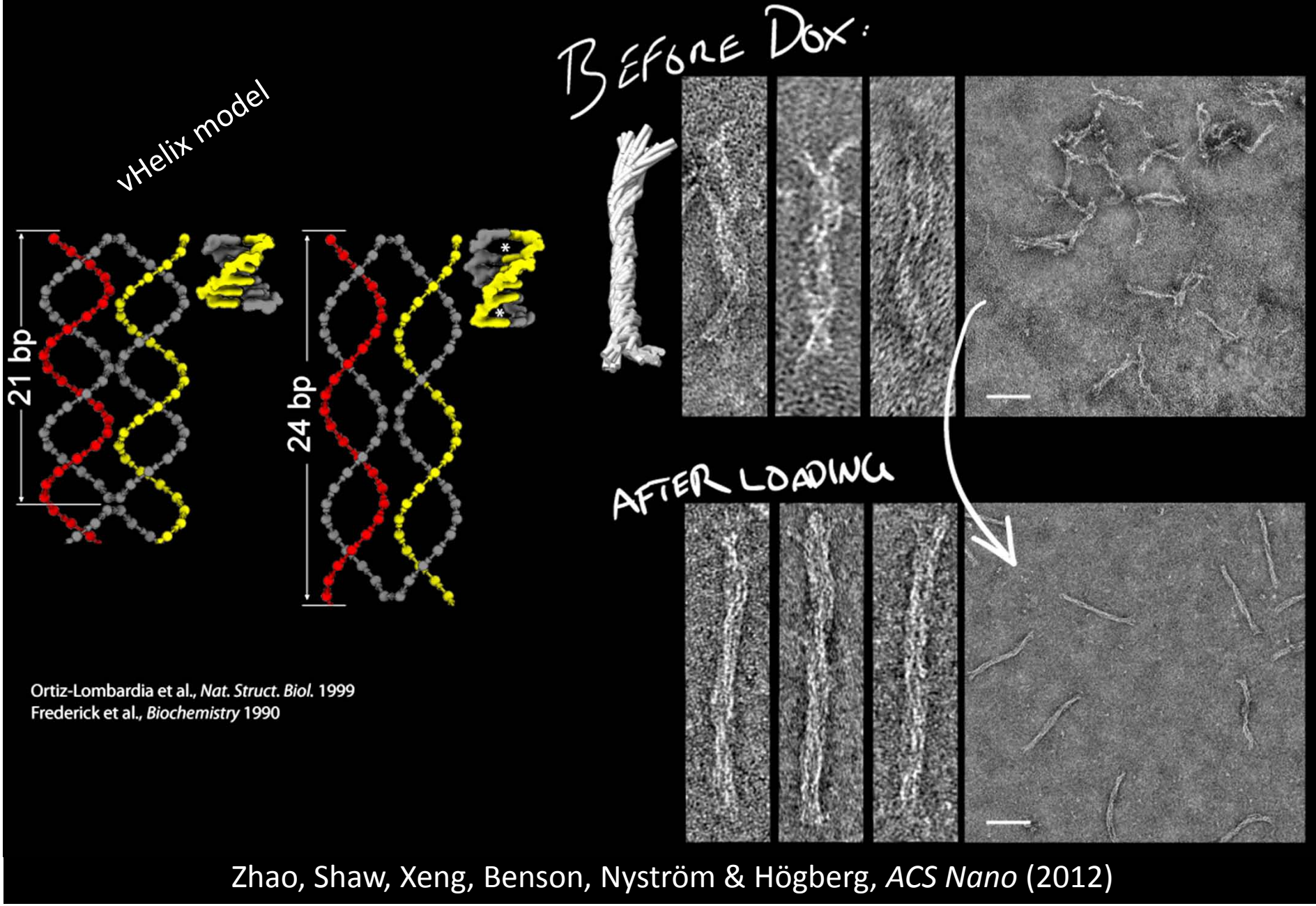


3.

Björn Högberg, Karolinska Institutet

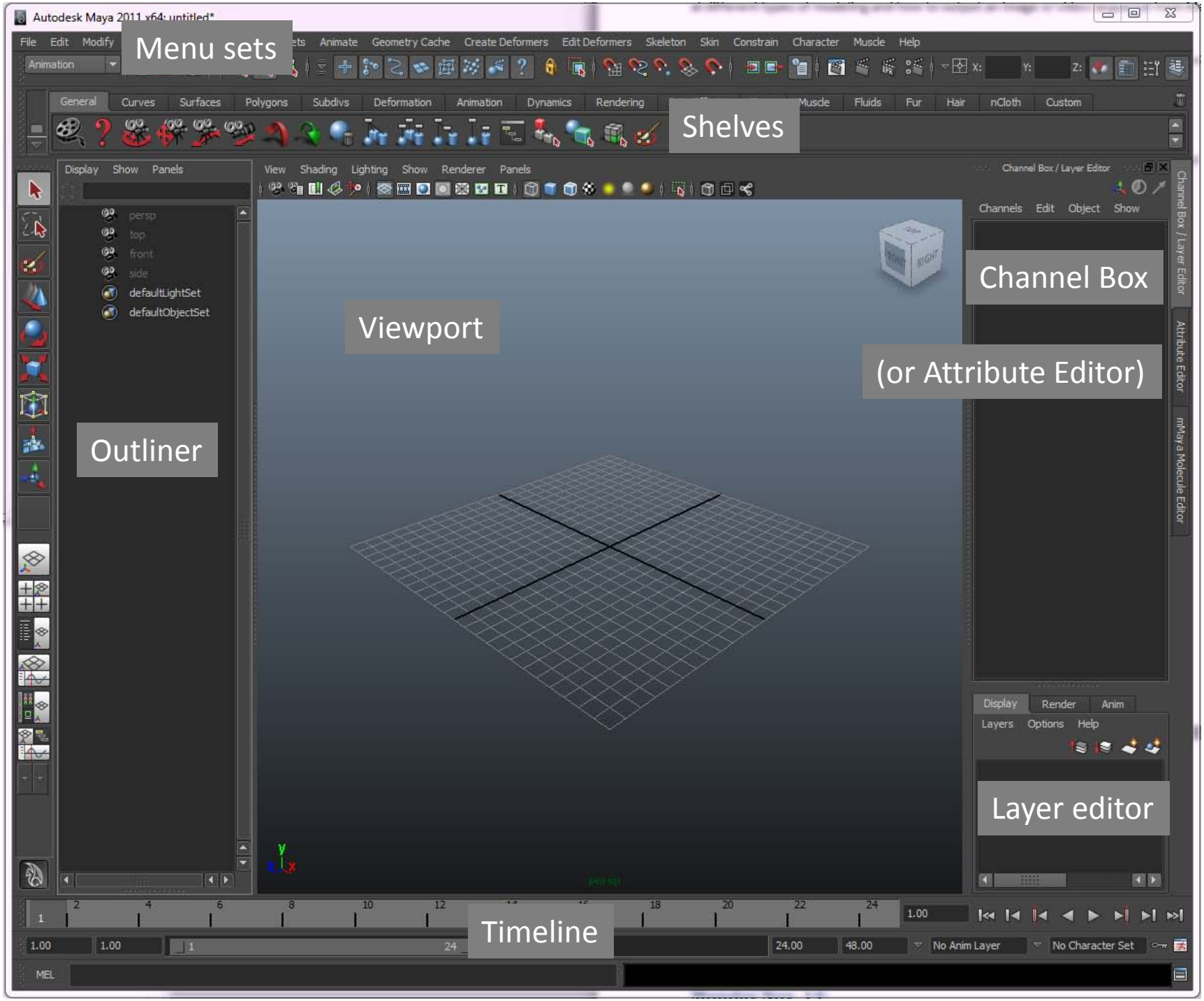
3D vis as a Hypotheses Tool



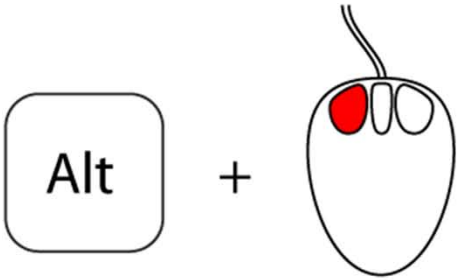
Zhao, Shaw, Xeng, Benson, Nyström & Högberg, *ACS Nano* (2012)

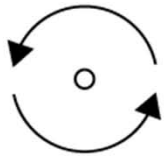
Rough Schedule Overview

- Mon, Feb. 10
  - Basic stuff, NURBS Modelling
- Tue, Feb. 11
  - Polygon Modelling cont., Deformers, Rendering stills
- Thu, Feb. 13
  - Rendering continued, Modelling DNA, proteins, cells.
- Monday, Feb. 17
  - Animation, rendering sequences, post-processing
- Wed, Feb. 19
  - Scripting, Dynamic constraints
- Fri, Feb. 21
  - Finishing off

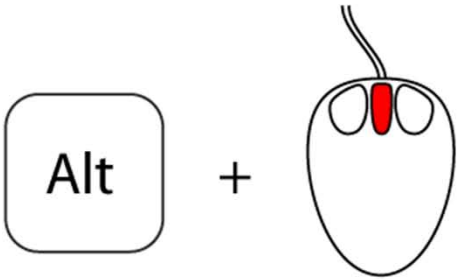

Menu sets
Shelves
Outliner
Viewport
Channel Box
(or Attribute Editor)
Layer editor
Timeline

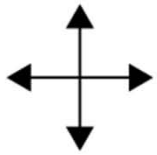
Basic Camera Manipulation



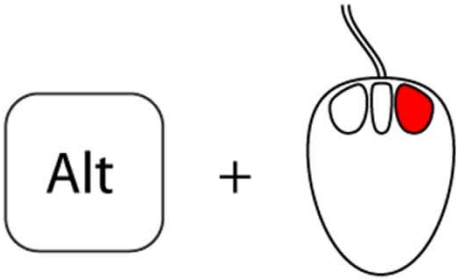


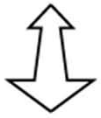
Tumble





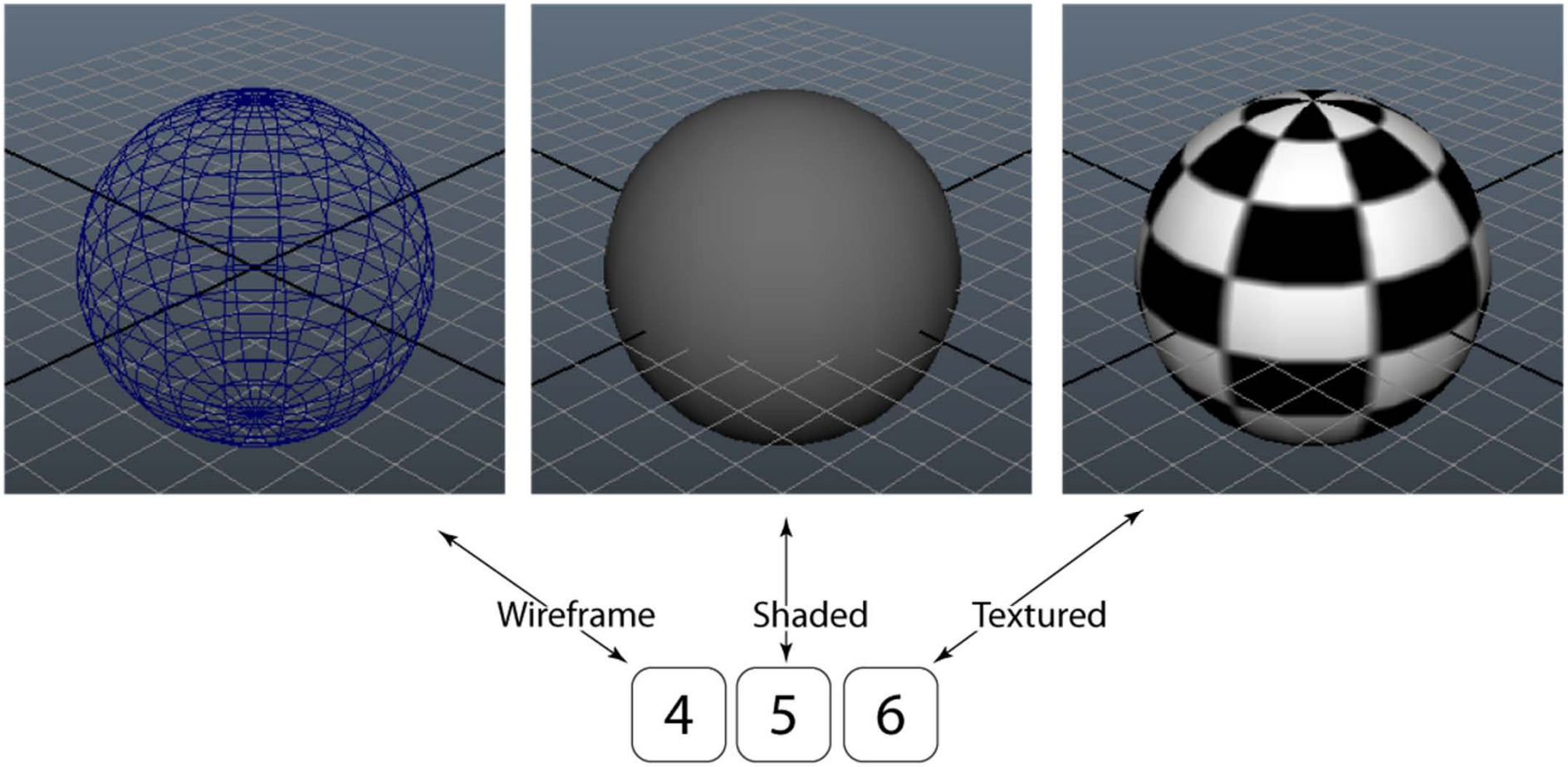
Pan





Dolly

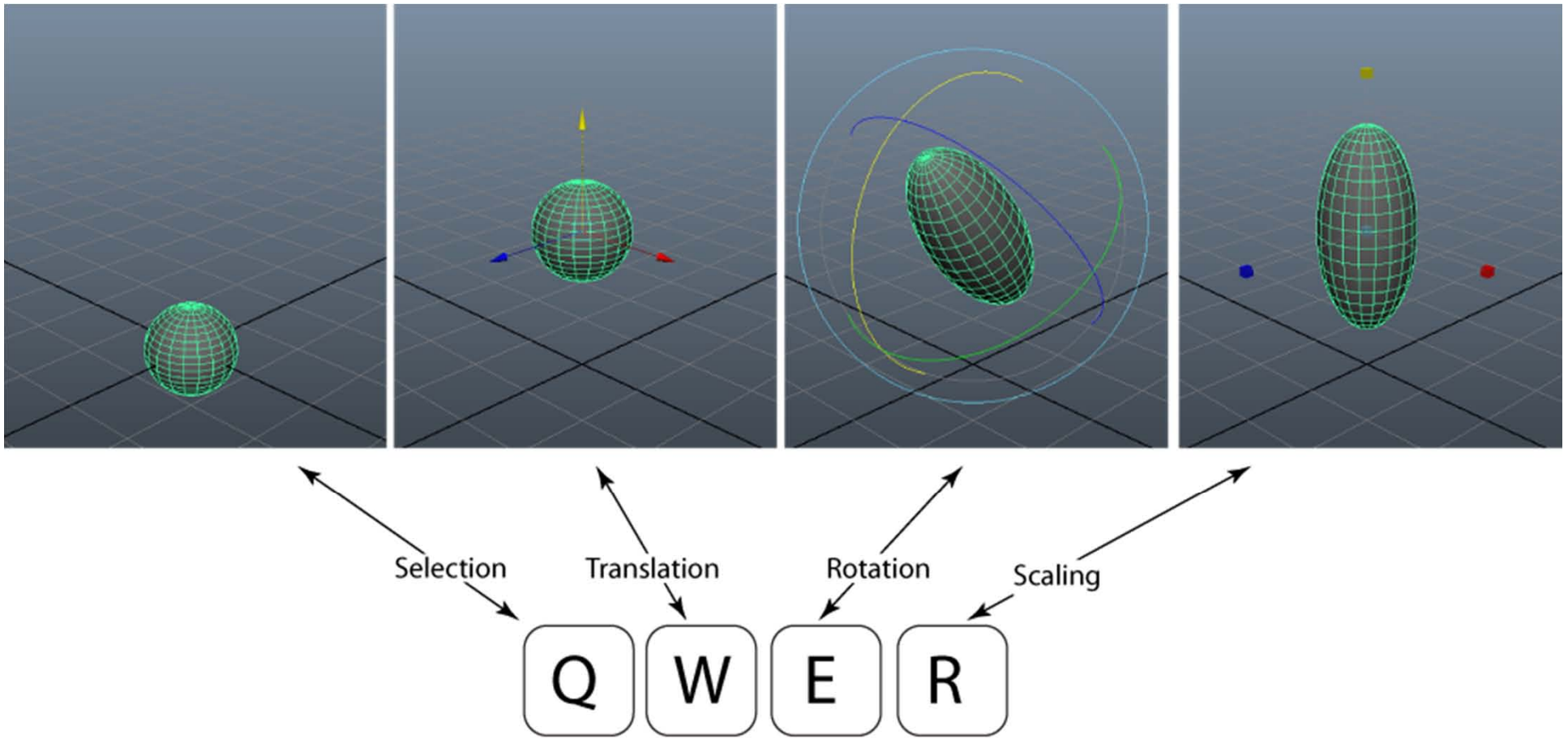
Shading modes



First exercises

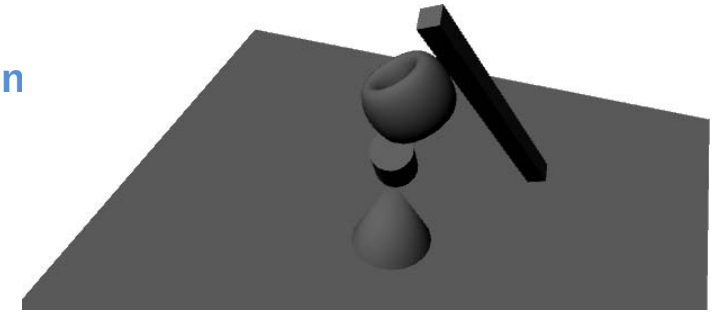
1. Create a new *project* named **WorkshopDay1**
2. Use default folders
3. Create a few primitives, try both with interactive creation and without.
4. Save your scene as **firstScene.000.mb**
5. Use **File->Project->Set**, set the project to the folder **WorkshopFiles**
6. Use **Open scene…**, if you set the project correctly, you should be in the scenes folder of the WorkshopFiles-project. Double click on the **segment001.mb** file
7. Try selecting objects with the marquee
8. Press **Q**, keep it pressed while pressing the **LMB** to get to the selection hotbox, select by dragging to **Lasso**. Try to select objects with the lasso.
9. Switch back to the marquee-selction mode by invoking the **Q hotbox** like in 8. Drag to **Marquee**
10. Group the cone and the large sphere and rename the group to **Blocks** in the outliner.
11. Switch between different view-modes by pressing: **4** (wireframe), **5** (shaded) and **6** (textured)
12. Try moving around with the camera (**Alt** + **LMB**, **MMB** or **RMB**)
13. Switch between the orthographic top + side views (**Space** or **Space** + **LMB** drag)
14. Try the viewcube, compare it to the orthographic views

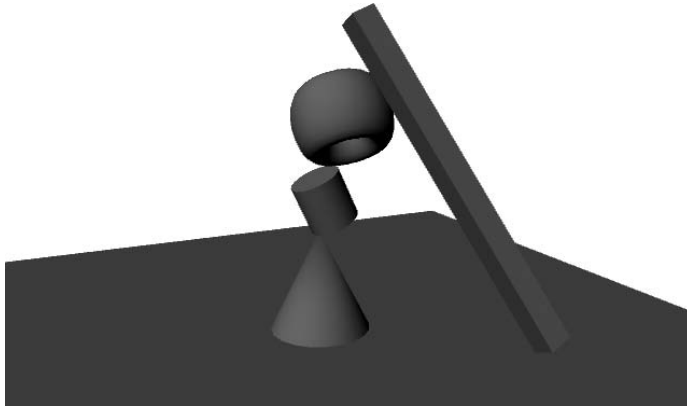
Basic Geometry Manipulation

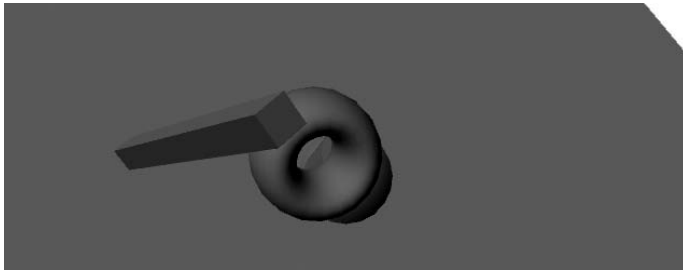


Scaling, rotating, translating, render

1. Set your project to **WorkshopDay1**, create new scene.
2. Turn of interactive creation for polygons (**Create->Polygon Primitives->Interactive Creation-uncheck**)
3. Create a polygon plane. Set scales **x**, **y** and **z** all to 30 to create a “floor”
4. Create a polygon cone, set all scales (**x**,**y**, and **z**) to 2.
5. Move it up so that it is standing on the floor. Use an orthographic side-view to position it. Use keyboard shortcut **f** to frame the selected object.
6. Save scene as **secondScene.000.mb**
7. Create a polygon cylinder. Change its **rotate z** to 25
8. Press **W**. Position it the cylinder as in the images.
9. Create a polygon torus and a polygon cube, try to scale them and position them as in the images. Use the shortcuts **W** (translate), **E** (rotate) and **R** (scale)
10. Save as **secondScene.001.mb**
11. In viewport menu, do: **view->Camera Settings->Resolution gate**
12. Render images like the ones here. Save as layered .psd-files (change in render settings)
13. Select the menu set **Rendering**, then **Render->Batch render**







Creating your first animation

1. Set your project to **`WorkshopDay1`**, create new scene.
2. Create a polygon cone.
3. Right click the **`Translate X`** in the channel box and select **`Key Selected`**.
4. Move the time slider to frame 24
5. Move the cone some distance in the x-direction.
6. Right click the **`Translate X`** in the channel box and select **`Key Selected`**.
7. Create another primitive
8. Try animating its translation, rotation and scale between frames 0-24
9. Use the shortcut S to key all keyable attributes of selected object
10. Save your scene as **`firstAnimation.000.mb`**
11. Open render settings.
12. Set **`Frame/Animation ext`**: to **`name.#.ext`**
13. Further down, make sure **`Start frame`** is 1 and **`End frame`** is 24 and **`By frame`** 1
14. Select the menu set **`Rendering`**, then **`Render->Batch render`**
15. Navigate to your **`images`**-folder in your project directory. Double click one of the .iff files.
16. In the fcheck program, do File->Open Animation (Open Sequence on Mac), select the first file in the sequence. To have fcheck show the sequence as an animation.

NURBS modelling I: Loft

1. Create a new scene.
2. Press **space**, LMB-click and drag to **Top View**
3. Activate the CV curve tool: **Create -> CV Curve Tool**
4. Create three smooth curves next to each other like in fig. 1 by clicking with the CV Curve Tool, see 5-6.
5. Press **enter** when you are satisfied with the first curve to exit curve creation.
6. Click the CV Curve Tool button  to the left, or **G** to get back to curve creation for the next curve.
7. Switch back to perspective view: Press **space**, LMB-click and drag to **Perspective View**
8. Drag two of the curves up so they all lie at different heights.
9. Select the bottom cuve, then shift-select the middle height curve and then last, shift-select the top curve.
10. Select the menu set **Surfaces**, then do LMB-click and drag to **Surfaces->Loft**
11. Hide the original curves: Select the curves, **Ctrl+H**
12. To un-hide: Select the curves in the outliner, **Shift+H**

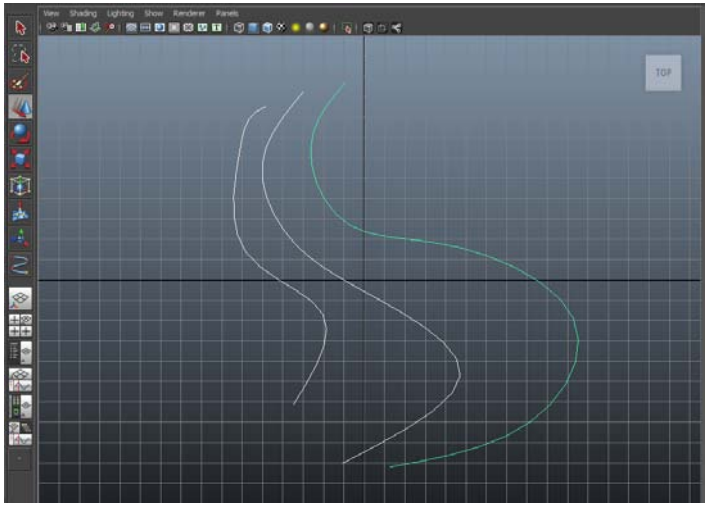


Fig. 1: Curves created in orthographic view

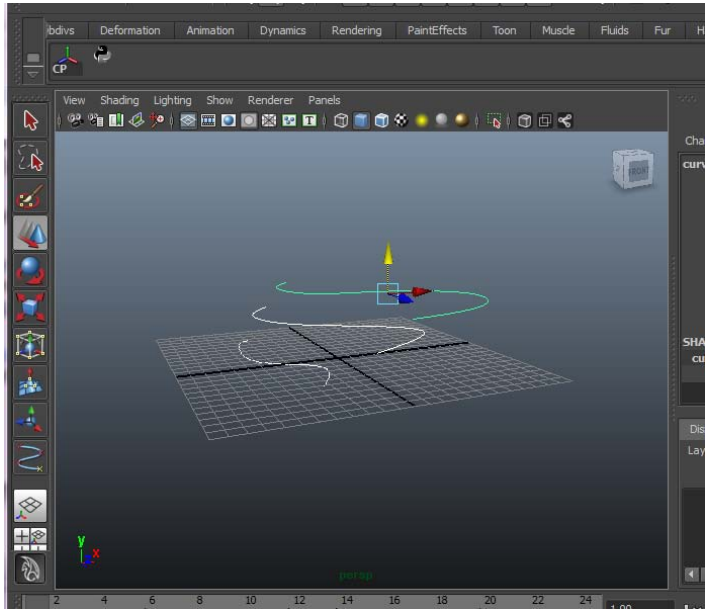


Fig. 2: Move two of them up

NURBS modelling II: Revolve

1. Create a new scene.
2. Press `space`, LMB-click and drag to `Top View`
3. Activate the CV curve tool: `Create -> CV Curve Tool`
4. Create one long connected curve like in Fig. 1
5. Press `enter` when you have enough points to exit curve creation. You will perfect the curve below.
6. RMB-click on the curve and drag to `Control Vertex`.
7. Move the CVs around, select multiple CVs by drag-select and use the scale tool (`R`) to spread out or compact them.
8. When you are satisfied with the curve. RMB-click on the curve and drag to `Object Mode`.
9. With the curve selected. Do `Surfaces -> Revolve` but press the little square icon to the right of `Revolve`.
10. On `Axis preset`, select `Z` and then press `Revolve`.
11. Using the move tool (`W`) move the created flask over to the right, like in fig. 2.
12. Try to do step 6-8 again to further refine the shape, watch how the revolved surface updates when you edit the curve
13. Save the scene as `flask.000.mb`

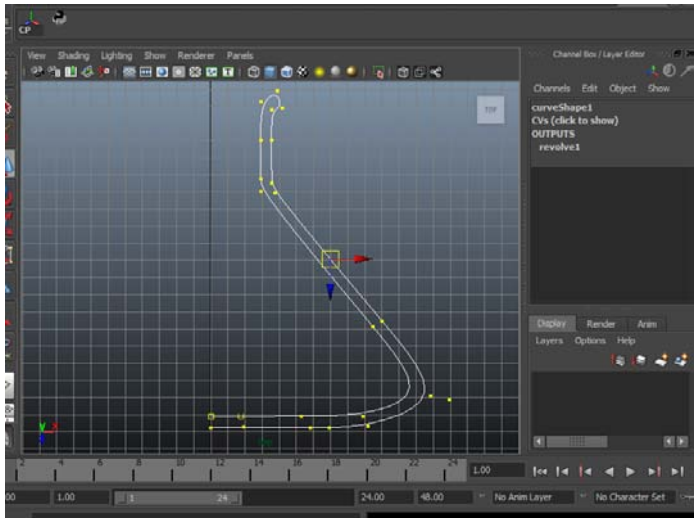


Fig. 1: Erlenmeyer flask curve

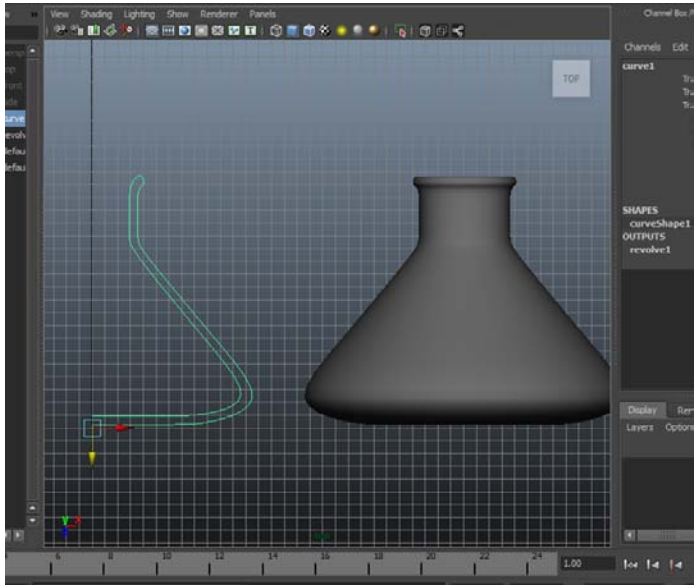


Fig. 2: Revolved!

NURBS modelling III: Extrude + Planar

1. Create a new scene.
2. Activate the CV curve tool: **`Create -> CV Curve Tool`**
3. Create one long connected curve like in Fig. 1
4. Press **`enter`** when you have enough points to exit curve creation.
5. Do **`Create -> NURBS Primitives -> Circle`**. To create a circle at the origin.
6. Select your circle, then shift-select the curve you created under 2.
7. Do **`Surfaces -> Extrude`** but click on the options box.
8. Select **`Style`** to be **`Tube`**, **`Result position`** to be **`At path`**, **`Pivot`** to be **`Component`** and **`Orientation`** to be **`Profile normal`** then press Extrude.
9. Try moving around the CV's of the original curve or re-scale the circle and watch the snake update on-the-fly.
10. To make caps: **`RMB`** click-and-drag on the tube, drag to **`Isoparm`**, **`LMB`** click on the very edge to select the edge isoparm. Do **`Surfaces -> Planar`**

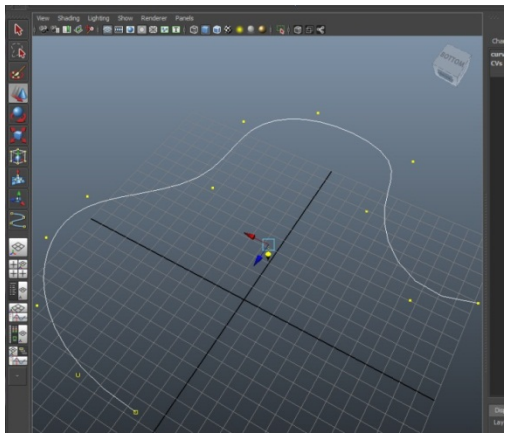


Fig. 1: Smooth curve...

Fig. 2: ...smooth snake