

RIGGING: FIRST LESSON ([link to lesson](#))



Standards alignment:
Common Core:
[8.G.A.1](#), [8.G.A.2](#),
[8.G.A.4](#),
[HSG.CO.A.2](#),
[HSG.CO.A.4](#),
[HSG.CO.A.5](#)

Summary/Overview:

“Rigging” is what Pixar artists call the process of digital puppeteering, which makes them more realistic and human. In this lesson, you’ll get to use the same toolbox that Pixar uses to animate a desk lamp and make a snowman smile.

Lesson Structure: This lesson contains 7 videos and 6 practice exercises which alternate back and forth. One way to run this is to watch and discuss all videos as a group (using a screen at the front of the room) while letting students return to their computers to do the exercises when required.

Total Time Recommended:

Approximately 60-90 minutes to complete the videos and exercises.

Age: Grade 5 - infinity and beyond!

Objectives:

In this lesson, students will:

- Learn to use geometric transformations to make a lamp jump
- Practice the basics of rigging joints on a character

Materials Needed:

- Indoor classroom, lab, or open space with seating and access to the Internet. Space should have enough seating, ideally facing a teacher/facilitator’s projection screen.
- Teacher/facilitator should have a computer connected to a large monitor or projector and speakers.
- This lesson assumes that each student or pair of students will require a device to access the lessons online.

VIDEO 0: Welcome to Rigging (length: 2 mins)

Instructions: Have everyone sit where they can see the screen. From the lesson page, play the video “Welcome to Rigging.” When the video ends, start a discussion with your group using questions below.

Key terms / Vocabulary:

- **Rigging** - a process of adding controls to a digital model to allow animators to move it around and act.
- **Deformation** - To change shape (form)
- **Displacement** - To change position (place)
- **Physiology** - the way body parts function

Discussion questions (5 mins):

- **Q:** Can you think of a character that would require more than 500 deformer for his or her face? What about fewer deformer?
- **Q:** Why do we rig characters?
- **A:** So that animators can move all the parts of their body

VIDEO 1: Rotate Deformers (length: 3 mins)

Instructions: First you'll connect shapes together using joints that rotate. Have everyone sit where they can see the screen. From the lesson page, play the video "Rotate Deformers." When the video ends, start a discussion with your group using questions below.

Key terms / Vocabulary:

- **Deformer** - a control that transforms a shape in any number of ways (rotate, translate, scale, to name a few.)
- **Rigger** - someone who creates and uses deformers to animate a character
- **Hierarchy** - The dependence of one part on another, determined by a rigger

Discussion Questions (3-4 minutes):

- **Q:** Why do you think it's harder to rig a human baby than a bouncing ball?
- **A:** More deformers are required to make it come to life
- **Q:** Look around you. What would be the hardest object for you to bring to life using rigging? Where would you put the first rotate deformer?
- **Q:** What is the purpose of a deformer?
- **A:** To control the transformation of the shape of a character

PRACTICE: Rigging Rotation Deformers (5-10 mins)

6 problems covering some key concepts

Instructions: After students are nearly finished, check for understanding before moving on to the next video (remind students they can find help in the hints for each question.)

Exercise Questions:

- **Q:** What did you learn about rigging rotation deformers in this exercise?

VIDEO 2: Translation Deformers (length: 3 mins)

Instructions: Now you'll need to start moving your lamp around using translations. Have everyone sit where they can see the screen. From the lesson page, play the video "Translation Deformers." When the video ends, start a discussion with your group using questions below.

Note: [Click here](#) to learn more about non- commutativity.

Key terms / Vocabulary:

- **Gestural drawing** - a quick and loose style of drawing that captures the idea rather than the all the little details
- **Axis of rotation** - The point about which things rotate
- **Non-commutativity** - Where the order of operations matters.
 - Addition is *commutative* because the order of operations does not matter, $3 + 5 = 5 + 3$.
 - Subtraction is *non-commutative* because the order of operations does matter, $3 - 5 \neq 5 - 3$.

Discussion Questions (3-4 mins):

- **Q:** Why does the order of transform and rotate deformers matter?
- **A:** If you rotate before you translate, you get a different effect than if you translate before you rotate.

PRACTICE: Rigging Translation Deformers (length: 15 mins)

7 problems covering basic concepts

Instructions: The goal is to move the lamp into place, and then pose it with rotations. After students are nearly finished, check for understanding before moving on to the next video (remind students they can find help in the hints for each question.)

Exercise Questions:

- **Q:** What did you learn about rigging translation deformers in this exercise?
- **Q:** In this exercise, can you describe the difference between rotating and translating?
- **A:** Rotating turns the model, translating moves along the x and y axes
- **Q:** Can you have a translate and rotate deformer on the same shape?
- **A:** Yes

VIDEO 3: Scale Deformers (length: 1 min)

Instructions: Now you can start scaling your shapes to make your lamp look younger. Have everyone sit where they can see the screen. From the lesson page, play the video “Scale Deformers.” When the video ends, check for clarifying questions before proceeding to the next exercise.

Key terms / Vocabulary:

- **Draw over** - a guide used for remodeling a character (in this case, a pink-lined drawing of the lamp)

Discussion Questions (3-4 mins):

- **Q:** Can you think of other animated characters that have scaled feet and head sizes to make them look younger?

PRACTICE: Create a younger model using scaling (length: 5 mins)

Instructions: After students are nearly finished, check for understanding before moving on to the next video (remind students they can find help in the hints for each question.)

Exercise Questions:

- **Q:** What did you learn about scale deformers in this exercise?

VIDEO 4: Putting everything together (length: 1 min)

Instructions: Have everyone sit where they can see the screen. From the lesson page, play the video “Putting Everything Together.” When the video ends, start a discussion with your group using questions below.

Key terms / Vocabulary:

- **Working “rough to fine”** - Transforming things that affect the whole shape first, like scaling the base.

Discussion Questions (3-5 mins):

- **Q:** In the lamp model, we’re using scaling to transform what?
- **A:** Size
- **Q:** True or False: It’s important to set the overall *scale* of the lamp first
- **A:** True: When you're working with controls like a *scale* deformer that affects a whole model or a bunch of parts, it's best to get the overall scale right before the individual parts. This is called working *rough to fine*.
- **Q:** What does the *translate* deformer help you to do?
- **A:** Move the lamp along the X (left & right) and Y coordinates (up and down)

PRACTICE: Rigging scaling deformers (length 5-10 mins)

5 problems covering basic concepts

Note: You may wish to review the first [animation lesson](#) prior to working on this exercise.

Instructions: After students are nearly finished, check for understanding before moving on to the next video (remind students they can find help in the hints for each question.)

Exercise Questions:

- **Q:** What did you learn about scale deformers in this exercise?

BONUS: Animate a Rigged Character (length 15-20 mins)

Instructions: Use the program below to animate the rigged lamp model. Can you animate a lamp that is happy? A tired lamp? A lamp that just ate something disgusting? A sneezing lamp? It may help to post these instructions where students can follow along while they work on the character rig. It might also help to take a few minutes to show/demonstrate before students start.

How to animate:

- Each deformer (there are 7) has a control at the bottom of the screen.
- The blue line shows the value of a deformer in each frame.
- Move the orange and pink control points to change the value of deformers.
- Click on the blue line to add new control points.
- Drag the orange point on top of the deformer control to change the current frame.
- This animation represents 24 frames, or 1 second of time.

How to save your animation:

- Press the save button; this will bring up a black box containing the code for your animation. To cancel, click on the faint "X" in the upper right corner of the box
- Copy all the text in the box and [paste it here](#) to create a new program.
- Save that program.
- If you see an X and several A's at the end of the code, delete them.

Finally:

- After students are nearly finished, check for understanding and see who would like to share their animation with the group.

VIDEO 5: Make a Face (length: 2 mins)

Instructions: Try out your deformer on a face. Have everyone sit where they can see the screen. From the lesson page, play the video “Make a Face.” When the video ends, start a discussion with your group using questions below.

Key terms / Vocabulary:

- **Directional scale** - a deformer that allows us to scale in just one direction (X or Y)
- **Shear deformer** - Similar to directional scales but causing the shape to slant.

Discussion Questions (2-3 mins):

- **Q:** Which direction does Y go?
- **A:** Vertical
- **Q:** Which direction does X go?
- **A:** Horizontal
- **Q:** If you wanted the hat on Knick to be extremely large, which directional scale should you use?
- **A:** Both, because you are increasing height AND width
- **Q:** In what order should you apply your deformer?
- **A:** Rough to fine

PRACTICE: Rigging Knick's Face (length: 5-10 mins)

Instructions: Add deformers to Knick's face and try changing the values. After students are nearly finished, check for understanding before moving on to the next video. Ask if any students would like to share their faces.

Exercise Prompts (2-3 mins):

- **Q:** What effects can you make?
- **Q:** Can you make him look happy, depressed, excited, angry?

VIDEO 6: Getting to Know Brian Green (length: 5 mins)

Instructions: Have everyone sit where they can see the screen. From the lesson page, play the video “Getting to Know Brian Green.” When the video ends, start a discussion with your group using questions below.

Discussion Questions (5-10 mins):

- **Q:** What inspired you about Brian’s experience?
- **Q:** Are there any Saturday morning cartoons that your parents let you watch? What? Why?
- **Q:** Have you ever built your own computer?
- **Q:** Do you like math AND art?
- **Q:** Have you ever made your own game?
- **Q:** Have you discovered any of your own passions?
- **Q:** Is there anything that makes you wonder “how did they do that?”
- **Q:** Do you think a Tesla coil could roast marshmallows?