# FOUNDATIONS IN MEDIA AND DIGITAL DESIGN: ANIMATION & GAME DESIGN

## TEACHER GUIDE

## THE ANIMATED WORLD

**DIGITALMEDIAARTS**

dma.edc.org

# Education Development Center, Inc.

## Development Partners

# Advisors

## Industry and Community Advisors

Deborah Brooks
The ACME Network

Milton Chen, PhD
The George Lucas Educational Foundation

Michael Feldman
Independent Sound Editor

Marilyn Friedman
DreamWorks Animation LLC

Pete Galindo
Independent Video Consultant and Educator

Patrick Jensen
DreamWorks Animation LLC

Kate Johnson
EZTV

Melissa Malinowsky
Independent Photo Editor

Erik Mason
Imaginary Forces

Dave Master
The ACME Network

Kathleen Milnes
The Entertainment Economy Institute

Dan Norton
Filament Games

Scot Osterweil
The Education Arcade

John Perry
The ACME Network

Brock Ramirez
Knowledge Adventure

Chris Runde
Bay Area Video Coalition (BAVC)

Jessica Sack
Yale University Art Gallery

John Tarnoff
DreamWorks Animation LLC

Moriah Ulinskas
Bay Area Video Coalition (BAVC)

Eric Zimmerman
Gamelab

## Secondary Educators and Pilot Teachers

*We are particularly grateful for the suggestions and guidance of the teachers who pilot tested the curriculum.

George Burdo*
Grant Communications Technology Magnet,
Los Angeles, CA

Joel Buringrud*
Harmony Magnet Academy, Strathmore, CA

Pam Carter
Santa Susana High School, Simi Valley, CA

Deborah Claesgans
Arts Education Branch,
Los Angeles Unified School District

Cathee Cohen
Grover Cleveland High School,
Los Angeles, CA

Virginia Eves
Office of College, Career & Technical
Education, San Diego Unified School District

Soma Mei-Sheng Frazier
Oakland School for the Arts, Oakland, CA

Shivohn Garcia
Paul Cuffee School, Providence, RI

Lorena Guillen*
John Muir High School, Pasadena, CA

John Hammelmann*
Harmony Magnet Academy, Strathmore, CA

Shawn Loescher
Office of College, Career & Technical
Education, San Diego Unified School District

Caroline Lorimer*
Metropolitan High School, Los Angeles, CA

Gail Marshall*
Van Nuys High School, Los Angeles, CA

Matt Maurin*
Edison High School, Stockton, CA

Jack Mitchell
California Department of Education

Frank Poje
History-Social Science Educator

Carlos Robles*
Media Arts Lead Teacher, Los Angeles, CA

Nicholas Rogers
Career Development Unit, DACE,
Los Angeles Unified School District

Mark Rosseau*
Richmond High School, Richmond, CA

Shawn Sullivan
Sheldon High School, Elk Grove, CA

## Post-Secondary Educators

Kristine Alexander
The California Arts Project,
California State University

John Avakian
Community College Multi-media
and Entertainment Initiative
College of San Mateo, CA

Brandi Catanese
University of California, Berkeley

Elizabeth Daley
School of Cinematic Arts,
University of Southern California

Amy Gantman
Otis College of Art and Design, CA

Evarist Giné
Professor of Mathematics,
University of Connecticut

Samuel Hoi
Otis College of Art and Design, CA

David Javelosa
Santa Monica Community College, CA

Jack Lew
Center for Emerging Media,
University of Central Florida

Sue Maberry
Otis College of Art and Design, CA

Tara McPherson
University of Southern California

Carol Murota
University of California, Berkeley

Casey Reas
University of California, Los Angeles

Carl Rosendahl
Carnegie Mellon University-
Silicon University Campus

Guy Smith
Santa Barbara City College, CA

Matt Williams
Institute for Multimedia Literacy,
University of Southern California

Holly Willis
Institute for Multimedia Literacy,
University of Southern California

Ellen Winner
Project Zero,
Harvard Graduate School of Education, MA

# Contents

# Unit Overview

*Long before the advent of motion pictures, humans made devices that used drawings to create the illusion of motion. Although the technology of the devices has evolved, the basic principles remain the same. Animation is a powerful means of creating works that entertain, enlighten, and amaze us.*

*In this unit, students learn first-hand the techniques and principles of animation. They learn hand-drawn pencil-and-paper animation, starting with the classic task of animating a bouncing ball. Students then learn computer-generated 2-D animation. Throughout the unit, they analyze animated movies made in a variety of animation forms and styles, looking at how the movies use the principles of animation as well as the elements of art and principles of design.*

*For their unit project, students develop an idea for an animated movie based on a short work of fiction. They select a scene to focus on, design one of the main characters, and create storyboards. Students then use pencil-and-paper and digital techniques to create an animation depicting a moment from their scene. At the end of the unit, students pitch their animated movie ideas to classmates and, possibly, arts, media, and entertainment (AME) professionals.*

*Students are also introduced to the Career Profile project, in which they choose a professional working in an AME field they are interested in, find out how this person began working in the industry, and critique one of this person's projects.*

**Unit Length**
**45 50-minute sessions**

# Unit Project Description

Students take on the role of an employee working on new movie development for an animation studio. Their assignment is to develop an idea for an animated movie based on a fairy tale, myth, folktale, or short story. For example, they might plan to tell the story of Icarus or La Llorona or one of the Raven tales from the Native American tribes of the Pacific Northwest. Students might even use a contemporary short story from their English language arts (ELA) class. Students are encouraged to choose stories that haven't been animated before or to set popular stories in a new context.

Students select a scene from their story and choose a moment from the scene to animate. They create a design for the main character, get feedback on their design, and create several drawings, including turnaround sheets, of their character. Students create storyboards for the moment they've chosen. As their final step, they animate that moment.

Students create drawings by hand, capture them digitally, and use 2-D animation software to complete their animations. At the end of the unit, students pitch their animated movie idea to classmates and, possibly, AME professionals.

# Assessment

Unit activities can serve as formative assessment tools. Observe students' developing techniques to gather information about their progress and to identify concepts or skills to reinforce within your instructional practice. The following activities are particularly useful for formative assessment:

- Penny bounce animation (Activity 1A.2)
- Ball bounce animations (Activities 1B.1–1B.3)
- Journal 1 (Activity 1B.2) and Journal 5 (Activity 2B.3)
- Walk cycle animations (Activity 2C)
- Pencil test of their animated moment (Activity 3B)

The project-based nature of the unit allows students to demonstrate their learning through authentic and relevant applications. Students will also keep portfolios of their work during the unit. For this unit, the summative assessment consists of the following items, the first three of which will be included in students' portfolios:

- Character designs, including a turnaround sheet, character studies showing expression, a model sheet, and a simplified design for animation
- Storyboards of a moment from the story
- An animated clip of a moment from the story

- Pitch of the animated movie concept
- Weekly critique assignments

The unit's Assessment Checklists detail the requirements that students must meet in order to successfully complete the project. A weight is suggested for each component. You will need to determine which specific technical and fine art skills you will teach in the unit and the criteria you will use to assess students' work.

If you wish to use a rubric, you can develop a tool that is consistent with your school's assessment system.

# Framing Questions

- How can I make the most of animation's special attributes to bring a story to life on screen?
- How can I create an animation that engages the audience and immerses them in the story I'm telling?
- What are the basic principles that animators use to create effective animations?

# Understandings

- The medium of animation allows animators to envision and develop a unique visual world that enhances and supports the story being told.
- Different forms of animation, such as pencil-and-paper, stop-motion, and computer-generated animation, all rely on the same fundamental principles.
- Effective animations employ established principles related to such elements as timing and staging.

# Technical Skills Taught and Practiced

- Principles of animation
- Story development
- Storyboarding
- Character development
- Effective use of the elements of art and principles of design in drawn animation
- Hand-drawn paper-and-pencil animation techniques
- Computer-generated 2-D animation techniques

**Teacher's Notes: Advice from Industry Pros on Drawing Animations**

Industry professionals recommend that students learn to animate by hand with pencil and paper before using technology. Making hand-drawn animations allows students to develop an understanding of the fundamentals of animation before learning how to apply those fundamentals in a software environment.

In this unit, students use pencil and paper to create animations before they work with 2-D software. It is strongly recommended that even if you adapt the unit, you give students experience with pencil-and-paper animations so that they learn the fundamentals.

# Where the Unit Fits In

This unit builds on what students have learned about storytelling, the three phases of production, and visual principles of media production during *D/M/A Foundations in Media and Digital Design: Audio & Video*. It also builds on *D/M/A Foundations in Visual Arts, Unit 5: Creating Characters*, drawing on what students learned in that unit about character development. This unit helps students learn how to communicate stories and ideas through different forms of media (animations, drawings, writing, and oral presentations) and strengthens students' reading and writing skills.

## Student Prerequisites

- Students should have completed ninth grade ELA and *D/M/A Foundations in Visual Arts* or an equivalent yearlong introductory visual arts course.
- Students should be familiar with the elements of art and principles of design.
- Students should have some experience with figure drawing and storyboarding, and they should be comfortable using digital cameras and tripods.
- It is recommended that students complete *D/M/A Foundations in Media and Digital Design: Audio & Video* before taking this course. If students have not taken the Audio and Video course, you may need to introduce and spend more time with storyboarding, the tasks involved in pre-production, production, and post-production, and the visual conventions of movies.

## Adapting the Unit

**Technology:** Given the variety of classroom setups and student experience levels, the unit project is designed to be flexible enough to meet the needs of different classroom situations. For example, you can have students create the animation using 2-D software rather than hand-drawing and then scanning or digitally photographing the drawings. There are notes throughout the unit on ways to adapt the project. Whichever approach you take, students should still learn the principles of animation and how to use animation effectively to tell a story.

If you don't have access to 2-D animation software:

- You can have students clean up and finish their drawings by hand and then create the animation by using the same software that they use for their pencil tests throughout the unit. (See Activity 1B for more information about this process.)
- You can have students do the project as a stop-motion animation, if you have access to digital cameras or video cameras. Students can use ready-made objects or puppets they create themselves. (If students create stop-motion animations, have them work in teams rather than individually.)

**3-D Animations:** This unit focuses on 2-D animation, but you can have students create 3-D animations in addition to or instead of 2-D animations. You may need to plan additional time for the unit, as 3-D animation is a complex process. You can also introduce students to the differences and similarities between 2-D and 3-D animation. For example, have students compare and contrast 2-D and 3-D movies or invite 2-D and 3-D animators to talk to students about the animation process.

**Career Profile Project:** In the unit, students work on the project independently, primarily outside of class. However, you may choose to have students work on the project in a more structured way during class. Please note that this approach will take additional time. If students have taken *D/M/A Foundations in Media and Digital Design: Audio & Video*, they will have completed the Career Profile project during that course. You may opt not to have students complete the project again during this course.


## Pacing and Sequencing

If students have not completed *D/M/A Foundations in Visual Arts, Unit 5: Creating Characters*, you will need to spend extra time having students analyze animated characters and introducing them to turnaround sheets and character studies. See Unit 5 Activities 1A, 1B, and 2B for activities that you can complete with students.

If students do not have experience with storyboarding, you will need to spend extra time teaching storyboarding basics. For information and activities related

to storyboarding, see *D/M/A Foundations in Visual Arts, Unit 3: Community Storytelling*, Activity 3A.

# Connections to Integrated Academic Units

Two- to three-week units, taught by teachers in the academic disciplines, help students integrate what they are learning in *The Animated World* with core academic classes.

*Transforming Figures (Algebra I, Geometry).* Students learn the mathematics behind animation, deepening their understanding of the illusion of motion. Students create flipbooks by applying transformations to geometric objects as they create the appearance of motion from one frame to the next.

*Proportion Matters (Algebra I, Geometry).* Students explore the head-to-body and facial feature proportions of humans and animated characters to understand the effect of these proportions on how we perceive a character's personality. Students learn to use proportions to create an animated character with specific characteristics.

*Casting a Novel Character (ELA).* Students learn to analyze characters and their development in a work of fiction. They select a character in a written work and imagine him or her as a main character in a TV show or movie. They craft monologues and dialogues that introduce the character and reveal his or her development.

*Animating Labor History (History).* Students form research teams to create authentic characters for an animated film about a significant event or movement in labor history. Teams gather information about individuals and stakeholders from their chosen period, as a way of documenting its issues, perspectives, and achievements.

## Other Opportunities for Integration

- Work with an ELA teacher to help students locate stories to animate and to help them understand such concepts as story arc and character development.
- Have students base their animations on a short story or narrative poem they are reading in ELA class.
- Work with an ELA teacher to structure or support students' Career Profile research and to review expectations for formal writing.
- Work with a math teacher to review the relationship between *volume* and *dimensions*, exploring how dimensions change but volume remains the same when a shape is squashed or stretched.

- Work with a social studies teacher to help students analyze the historical content in animations based on historical events, such as *Grave of the Fireflies*, which is about the effects of World War II on the life of two children in Japan.

# Career Connections

Students learn and practice skills such as drawing, developing characters, creating storyboards, and creating animations, all essential for careers in animation and in related AME careers.
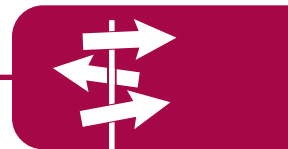
## Ideas for Involvement with Professionals

- Invite an animator to talk to students about the process of creating animations.
- Invite a character designer (for animation or gaming) to talk to students about aspects of the character design process.
- Invite AME industry professionals to critique students' work in progress or to attend students' pitch sessions at the end of the unit.

  **Note:** Activities 2B.3 and 3B offer good opportunities for AME professionals to provide feedback on students' work in progress.

- Have students read or watch online interviews with animators. (See *Media & Resources* for links.)
- Plan a class visit to an animation studio, to the studio of a freelancer who works on cartoons or animations, or to a company that produces animations for advertising (e.g., for Web sites).

## Key Careers

Through activities in this unit, students learn about the following careers:

- Storyboard assistant
- Animation supervisor
- Lighter

# Table of Activities

## Part 1: Introduction to Animation (7 50-minute sessions)

Students are introduced to the basic principles and techniques of animation. They begin the unit with a simple project—animating a penny using stop-motion animation—and then analyze clips from animated films to learn about several of the principles of animation and to see how the elements of art and principles of design are used. Students practice a classic animation task, animating a bouncing ball, using both pencil-and-paper and computer-generated techniques.

### Activity 1A: The Principles of Animation (3 sessions)

| | |
|---|---|
| *1A.1:*<br>*Why Animation?* | Students watch and discuss a clip from an animated movie and are introduced to the unit. |
| *1A.2:*<br>*Animating a Penny* | Working in teams, students use digital cameras and stop-motion animation software to animate a penny, giving it the appearance of bouncing across a page. |
| *1A.3:*<br>*Seeing the Principles of Animation at Work* | Students are introduced to several of the 12 basic principles of animation and identify how each is used in an animated movie clip. |
| *1A.4:*<br>*Looking at the Elements of Art and Principles of Design* | Students identify the ways that animators use the elements of art and principles of design in a movie clip. Students are introduced to the weekly critique assignment. |

### Activity 1B: Follow the Bouncing Ball (4 sessions)

| | |
|---|---|
| *1B.1:*<br>*Introduction to Straight-Ahead Animation* | Students are introduced to hand-drawn animation by using straight-ahead techniques to animate a bouncing ball. Students then create pencil tests of their work. |
| *1B.2:*<br>*Introduction to Pose-to-Pose Animation* | Students use pose-to-pose animation techniques to complete another bouncing ball animation and then create new pencil tests. |
| *1B.3:*<br>*Introduction to 2-D Computer Animation* | Students learn the basics of a 2-D animation software program and create a third animation of a bouncing ball, using the animation principles they have learned so far. |
| *1B.4:*<br>*Introducing the Career Profile Project* | Students learn about careers related to the work they are doing in the unit and are introduced to the Career Profile project. Students conduct research on AME professionals whom they may want to profile. |

# Part 2: Finding the Right Story (15 50-minute sessions)

Students begin work on their unit project. They select a story, choose a scene from the story and a moment from that scene, and design one of the main characters. Students then create several drawings of their character. To more fully understand the techniques and principles of animation, students learn about and practice drawing walk cycles.

## Activity 2A: Developing the Story (3 sessions)

| | |
|---|---|
| **2A.1:** <br> **Choosing a Story** | Students are introduced to the unit project and watch a clip from an animated movie based on a fairy tale, myth, folktale, or short story. Students conduct research and choose the story for their unit project. |
| **2A.2:** <br> **Choosing a Scene and a Moment** | Students select a scene from their story and choose one moment from that scene to animate for their unit project. |

## Activity 2B: Developing the Character (8 sessions)

| | |
|---|---|
| **2B.1:** <br> **Initial Character Design** | Students learn about two more principles of animation. They sketch out a character design, conducting research on the character's visual attributes. Students share their designs and revise them based on feedback. |
| **2B.2:** <br> **Creating Turnaround Sheets and Character Studies** | Students develop turnaround sheets and character studies showing expression. |
| **2B.3:** <br> **Finalizing the Character Design** | Students created polished model sheets showing their character in a typical pose. They also create simplified versions of their character to use in their animations. |

## Activity 2C: All About Walk Cycles (4 sessions)

Students learn about creating walk cycles, a challenging and important task for animators. They watch a clip from an animated movie in order to analyze how characters move as they walk. Students create a walk cycle animation for a simple figure and for their own character.

## Part 3: Creating the Animation (20 50-minute sessions)

Students animate a moment from a scene in their story. To prepare, they create a storyboard of the moment. They draw the frames for their animation, capture their drawings with a camera or scanner, and ink in and animate the drawings using 2-D software.

Students incorporate the principles of animation as they work, trying to effectively use the elements of art and principles of design. Throughout the process of creating their animations, students revise their work based on feedback.

### Activity 3A: Creating Storyboards (3 sessions)

| | |
|---|---|
| *3A.1:*<br>*More Principles of Animation* | To learn about the remaining principles of animation, the class analyzes a clip from an animated movie. |
| *3A.2:*<br>*Storyboarding the Moment* | Students create a detailed storyboard of the moment in their story that they plan to animate. |

### Activity 3B: Drawing the Moment (10 sessions)

Students draw the key frames of their animation, create a pencil test to help them determine the timing of the animation, and get feedback on their pencil tests. Students then draw their animations and create a second pencil test.

### Activity 3C: Creating Digital Animations (7 sessions)

Students work with their drawings in 2-D animation software. They ink in their pencil drawings and make adjustments to the animation based on feedback they receive. Students may also color in their drawings.

## Part 4: Pitching the Work (3 50-minute sessions)

Students prepare and deliver pitches for their animated movie idea to an audience of classmates and, ideally, AME professionals. Students reflect on their work in the unit.

### Activity 4A: Preparing for the Pitch (1 session)

Students develop their presentations for the pitch session.

### Activity 4B: Pitch Session (2 sessions)

Students pitch their animated movie ideas to the class and reflect on what they learned during the unit.

# Advance Preparation

- Look over **Materials Needed** at the end of the unit and order any needed equipment or supplies. Become familiar with the software programs you will use during the unit and determine how you will introduce them to students. Be sure that students have access to how-to guides or operating manuals as they work.

  **Note:** Students need access to three kinds of equipment: for drawing animation by hand, for creating stop-motion animations and pencil tests, and for creating 2-D computer-generated animations. Suggestions are provided in **Materials Needed**, but you can use any equipment that allows students to successfully complete these three tasks.

- Read **Student Prerequisites**, **Adapting the Unit**, and **Pacing and Sequencing** and plan for any additional activities or support that students will need to successfully complete the unit.
- Read **Career Connections**, determine how you will engage students with AME professionals during this unit, and either invite AME professionals to visit the classroom or arrange for a class visit to a related business. Determine whether to have AME professionals critique students' work in Activities 2B.3 and 3B and/or attend the pitch session in Activity 4B. Plan to schedule these visits before beginning the unit.
- For more information about the animation process, you may wish to look at the books and Web sites listed in *Media & Resources: General Animation Resources*.
- Internet resources, provided as links in *Media & Resources*, are recommended throughout the unit for student or in-class use. These Web sites have been checked for their availability and for advertising and other inappropriate content. However, because Web sites' policies and content change frequently, we suggest that you preview the sites shortly before using them.
- Look at **Appendix A: Additional Animation Exercises** and determine if and when you will give students these additional assignments.
- As the unit is written, students select their own stories to animate for the unit project. If you think this task may be too challenging for students, you may select a story for them.

RESOURCES

# Part 1: Introduction to Animation

Students are introduced to the basic principles and techniques of animation. They begin with a simple project—animating a penny using stop-motion animation—and then analyze clips from animated films to learn about principles of animation and to see how the elements of art and principles of design are used. Students practice a classic animation task, animating a bouncing ball, using both pencil-and-paper and computer-generated techniques.

**Length**
**7 50-minute sessions**

## Activity 1A: The Principles of Animation

Students learn about and practice the principles of animation.

### Sequence

| | |
|---|---|
| **1A.1:**<br>**Why Animation?** | Students watch and discuss a clip from an animated movie and are introduced to the unit. |
| **1A.2:**<br>**Animating a Penny** | Working in teams, students use digital cameras and stop-motion animation software to animate a penny, giving it the appearance of bouncing across a page. |
| **1A.3:**<br>**Seeing the Principles of Animation at Work** | Students are introduced to several of the 12 basic principles of animation and identify how each is used in an animated movie clip. |
| **1A.4:**<br>**Looking at the Elements of Art and Principles of Design** | Students identify the ways that animators use the elements of art and principles of design in a movie clip. Students are introduced to the weekly critique assignment. |

## Materials Needed

- Short clip from a familiar animated movie (see *Advance Preparation*)
- **Handout 1: Unit 1 Overview**
- Digital cameras and tripods (1 of each per team)
- Pennies (1 per team)
- White paper (8½ x 11 inches or larger—2 sheets per team)
- Optional: Clear tape, wall putty, or other adhesive (if teams will photograph the penny on a wall instead of on a table)
- **Handout 2: Animating a Bouncing Penny**
- Software for creating stop-motion animations (see *Advance Preparation*)
- **Handout 3: Principles of Animation #1**
- Two short animated movie clips that demonstrate four principles of animation (see *Advance Preparation*)
- Optional: Dry-erase marker
- **Handout 4: Elements of Art and Principles of Design**
- **Handout 5: Weekly Critique** (multiple copies per student)
- **Assessment Checklist 1: Weekly Critique** (multiple copies per student)
- List of links to online animated clips (see *Advance Preparation*)

## Advance Preparation

- Select a short, engaging clip from an animated movie that students are familiar with. (See *Media & Resources* for suggestions.)
- Before Activity 1A.2, select software that students will use for creating stop-motion animations of their pennies. (See *Media & Resources* for software suggestions.) Test the penny animation process to make sure that the equipment and software work properly and to identify points during the process when students may need help.
- Before Activity 1A.3, select two short animated 2-D movie clips that each demonstrate the four principles of animation described on Handout 3: squash and stretch, slow in and slow out, arcs, and timing. (See *Media & Resources* for suggestions.) View the clips and identify the ways that they use these principles.

  **Note:** Sample analyses of *Sleeping Beauty* are provided in the Teacher's Notes in Activities 1A.3 and 1A.4.

- Before Activity 1A.4, prepare a list of links to online animated clips that students may view on their own for the weekly critique assignment. (See *Media & Resources* for suggestions.)

RESOURCES

## 1A.1: Why Animation?

**1. Play animated movie clip and discuss animation.**

Play the clip of a familiar animated movie. Encourage students to discuss the clip by posing the following questions:

- Did you enjoy watching the clip? If so, what made it enjoyable?
- How would this clip have been different if it had been a live-action movie, rather than an animation, telling the same story?
- Why might someone choose to make an animated movie rather than a live-action movie to tell a story?

  *Possible answers: Because the story would benefit from the visual freedom that animation provides; because elements of the story (such as dragons or fairies) would be challenging to depict in a live-action movie; because exaggeration and emphasis appropriate to the story would be easier to accomplish; because the target audience (usually children) would enjoy seeing the story in animated form.*

- What are some of your favorite animated movies? Why?

**2. Introduce the unit.**

Distribute **Handout 1: Unit 1 Overview**. Explain that students will learn about the basics of animation, focusing on both hand-drawn and computer-generated 2-D animation. Tell students that during this unit they will learn to create their own animations. Describe the unit project.

Draw attention to the vocabulary list and tell students that they should refer to this list if they encounter unfamiliar terms.

> **Note:** Some vocabulary terms, such as *breakdown poses* and *inbetween poses*, may not make sense to students until they actually experience the process of animation later in Part 1.

## 1A.2: Animating a Penny

> **Note:** This activity provides a good opportunity for formative assessment.

**1. Introduce the activity.**
Tell students that to learn about the animation process, they will practice making a simple stop-motion animation.

Divide the class into teams and give each team the following:

- Digital camera
- Tripod
- Penny
- Two sheets of white paper
- Clear tape or other adhesive (if they will photograph the penny on a wall instead of a table—see Handout 2 for more information)

Give students **Handout 2: Animating a Bouncing Penny** and go over the instructions.

**2. Have teams take photographs for their first penny animation.**
Have students follow the instructions in Steps 1–4 of Handout 2, taking a photograph each time they move the penny an even distance. Help students troubleshoot the process as necessary.

> **Note:** If the digital cameras have manual functions, have students set a fixed focus and exposure. This way, the background won't flicker if the ambient light in the room changes. Also, depending on the software that students will use, the camera may be connected to a computer as they are shooting.

**3. Have teams create their first animations.**
Show students how to import their photographs and use the software that you've chosen to create their animations (Step 5 of Handout 2). Have teams create a loop in which the penny seems to bounce several times. Make sure that each team creates a successful animation. Show students how to use the software to experiment with holds and frame rates, as described in Steps 6 and 7, and then have them do so.

> **Note:** To hold a frame, students need to insert a duplicate image into the sequence of images in the software. Students will use the same process when they create their pencil tests.

When students play their animations at 12 fps, they should find that the animation takes about twice as long and the penny moves more slowly.

**4. Have teams take photographs for and create their second animations.**
Have students follow the instructions in Steps 8–10 of Handout 2 to create an animation in which the penny is moved a shorter distance between shots at both the beginning and end of the "bounce" and is moved a greater distance between shots when the penny moves toward the "floor." Make sure that each team successfully creates an animation.

**5. Discuss animation, spacing, and timing with students.**
Ask students the following questions:

- Did anything surprise you about the process of animation?

  *Possible answers: Students may mention that it took a lot of work, and a lot of photographs, to create a very short animation.*

- What differences did you notice in the motion of the penny in the two animations?

  *Possible answers: While the penny in the first animation maintained an even rate of speed throughout the bounce, the penny in the second animation moved more slowly at the top of the bounce and more quickly as it moved toward the "floor," mimicking more closely the actual motion of a bouncing object.*

  **Note:** Because the animation is so short, these differences may be subtle.

- Why might an animator have an object move at different rates of speed, as you did during the second animation?

  *Possible answers: One reason is that this creates a more realistic animation that mirrors what happens to objects in the real world (which move at different rates depending on their weight, direction of motion, and other factors). In the example of an object bounced or thrown up into the air, the force launching the object upward slowly loses momentum due to the force of gravity, which eventually brings the object back down. Whether the object bounces up again depends on its weight, the material it is made of (for example, metal or rubber), and the surface it bounces on.*

  *Another reason that animators might have objects move at different rates of speed is to create visual interest.*

- Based on your experience creating the two animations, what effect does changing the spacing of the images of an object have on an animation? What's the relationship between spacing and timing?

  *Possible answers:*

  - *The closer the spacing of the images of an object or character in consecutive animation frames, the more slowly the object or character seems to move.*

- *When greater spacing of images is used, the object or character seems to move more quickly.*
- *The spacing of objects and characters thus determines the timing of the resulting animation. Using different timing can also make objects appear to behave as though they are made of different materials (responding differently to physical forces)—for example, quick timing may make a ball appear to behave like a bouncy rubber ball, while slower timing may make a ball appear to behave like a heavier bowling ball.*

**Note:** You may want to tell students that if the spacing is too great between images of an object, the object's movement may start to look jumpy. However, sometimes an animator deliberately creates this effect. (For example, an object that is hit with great force may move backward in a "popping" motion.)

## Handout 1:
# Unit 1 Overview

*Think about a moment in an animated movie that really moved you—maybe you cried when Bambi lost his mother, or your heart soared at the moment in* Up *when the house became airborne. You felt real emotions, maybe even cried real tears, even though there were no actors that you could see, no real house soaring through the sky—just lines and color captured on film or as pixels. That's the magic of animation. Animators create imagined worlds and bring them so convincingly to life that we believe in the characters and get lost in the story.*

*In this unit, you will learn how to create some of this magic yourself. You'll learn the basic techniques of animation and the principles that animators use to create believable characters and worlds. You'll practice some classic animation exercises and analyze animated movies. For the unit project, you'll select a short work of fiction that you think would make a good animation and create an animation of a moment from the story.*

*Your work in this unit will revolve around the following questions:*

- *How can I make the most of animation's special attributes to bring a story to life on screen?*
- *How can I create an animation that engages the audience and immerses them in the story I'm telling?*
- *What are the basic principles that animators use to create effective animations?*

## Unit Project

You'll take on the role of an employee working on new movie development for an animation studio. You are given the task of selecting a short piece of fiction—a fairy tale, a folktale, a myth, or a contemporary short story—that would make a successful animated movie. Once you choose your story, you'll select a scene from the story and a moment from that scene to focus on, develop a design for one of the animation's main characters, storyboard the moment you've chosen, and create an animation of the moment. At the end of the unit, you will pitch your story idea to your classmates and, possibly, arts, media, and entertainment (AME) professionals.

## What You Will Do in This Unit

**Note:** According to animation industry professionals, it's a good idea to learn how to animate by hand with pencil and paper before moving on to computer-based animation. You'll learn animation fundamentals with pencil and paper, which you can then apply to the animation you create using computer software.

***Animate a penny.*** Create a stop-motion animation of a bouncing penny to learn the basic techniques used to make animation.

***Analyze animated movies.*** Watch clips from animated movies and analyze the way that they use essential principles of animation, as well as the elements of art and principles of design.

***Write a weekly critique.*** Write a weekly analysis of a clip from an animated movie, short, or TV show that you view outside of class.

***Draw a bouncing ball animation.*** Draw an animation of a bouncing ball, incorporating several principles of animation.

***Create a computer-generated bouncing ball.*** Use software to create a 2-D animation of a bouncing ball, using the same principles you used in the hand-drawn animation.

***Profile an AME professional.*** Begin research on a project in which you'll choose an AME professional you admire, research this person's education and career path, and critique one of his or her projects.

***Choose a story to animate.*** Select a short work of fiction that you think would make a good animated movie, and select a scene and a moment from the scene to focus on.

***Design a character.*** Design the main character in the moment you've chosen, creating several different drawings as part of the design process.

***Practice animating a walk cycle.*** Learn how to animate simple walking figures in order to understand how walk cycles work in animation.

***Create storyboards.*** Draw storyboards of the moment that you've chosen from your story.

***Animate a moment.*** Create a short animation of the character you've designed in a moment from your story.

***Pitch your story idea.*** Share your story idea, character designs, storyboards, and animation with an audience.

## Portfolio Requirements

You will keep a portfolio of work throughout the unit that includes the following items:

- Character designs, including a turnaround sheet, character studies showing expression, a model sheet, and a simplified design for animation
- Storyboards of a moment from the story
- An animated clip of a moment from the story

## Vocabulary Used in This Unit

*Animation:* The process of playing a consecutive sequence of drawings, computer-generated graphics, or photographs to create the illusion of motion.

*Breakdown poses:* Poses located between key and extreme poses that show the path that the action takes.

*Character studies:* Drawings that show a character displaying a variety of actions or emotions.

*Extreme poses:* Poses that show changes in motion or dramatic changes in shape (such as those showing squash and stretch) between the key poses.

*Frame:* An individual image that, when played consecutively with other images, creates the illusion of motion in an animation.

*Frame rate:* The speed at which individual frames in an animation are played back to create the illusion of motion. Frame rates have a direct effect on the timing and smoothness of the animation.

*Inbetween poses:* Poses other than keys, extremes, and breakdowns, which are necessary to create appropriate timing and movement in an animation.

*Inking in:* The process of tracing over pencil drawings (with ink or with a digital tool) to create the final images for an animation.

*Key poses:* Poses that show the most important moments in the action, such as the beginning and end of the action or changes in the direction of the action. These are also known as key frames.

*Model sheet:* A page that shows a polished drawing of a character in a typical pose wearing a typical costume. May also include turnaround drawings of the character.

*Pencil test:* An animation of initial drawings for an animation project, usually completed before work begins on the final product.

*Pose:* The position of a character or object in one frame of an animation.

*Primary action:* The most important movement a character completes in a scene.

*Secondary action:* Movement made by a character in a scene that is in addition to the character's primary action. This secondary movement can add interest to a scene or provide more information about a character.

*Spacing:* The distance that an object or character moves between one frame of an animation and the next. The closer the spacing, the more slowly the object or character appears to move.

*Stop-motion animation:* A method of animation in which each frame is a photograph of real-world objects, which are then moved incrementally between frames. Played in sequence, the frames create the illusion that the object is moving.

*Storyboards:* Drawings of shots or frames from scenes in a media production. Used in the pre-production process to plan scenes before they are shot or animated.

*Turnaround sheet:* A page of drawings of a character that shows the character from all sides, often including front, back, side, and three-quarter views.

*Tweening:* In computer-generated animation, the process of having the software generate inbetween frames.
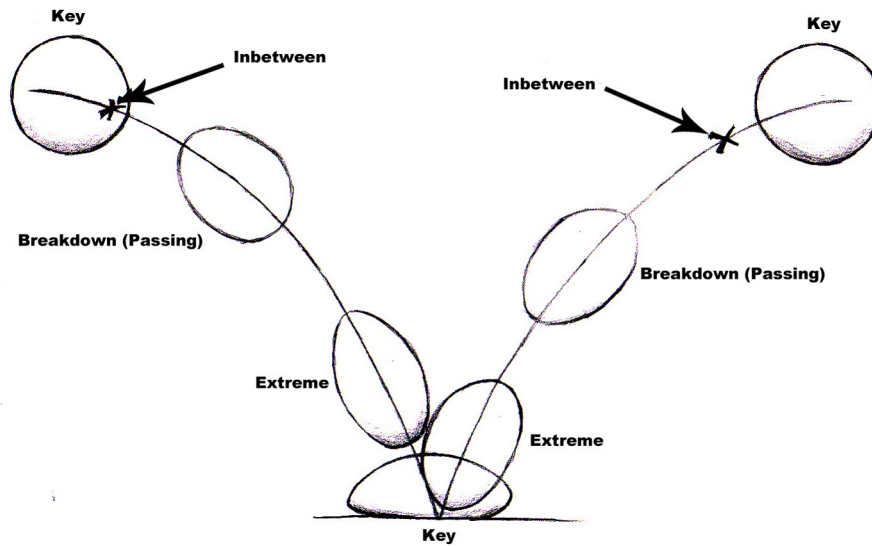
Poses in a bouncing ball animation. Deciding on which poses are the key, extreme, or breakdown poses is different for every animation, but all animators identify the important poses to help plan the motion in the animation. Drawing by Brock Ramirez.

## Handout 2:
# Animating a Bouncing Penny

To learn how to animate, you don't need a pencil or a computer program, just a penny and a camera. You'll create your first animation using the technique known as stop motion, in which each frame of the animation is a photograph of a real-world object. You'll move the object incrementally between each frame. When the frames are played in sequence, they create the illusion that the object is moving.

## First Animation

### Step 1: Plan the path your penny will take.

You will move a penny along a path on a white background, taking a photograph each time you move the penny. These photographs will be the frames of your animation.

---

**Note:** A *frame* is an individual image that, when played consecutively with other images, creates the illusion of motion in your animation.

---

The penny should appear to bounce from left to right, starting at the top left corner, moving down to the "floor" in the bottom center, and traveling up to the top right corner.

Place your background (a sheet of white paper) on a table and draw a faint pencil line to mark the path your penny will take. Your path should look similar to the following:
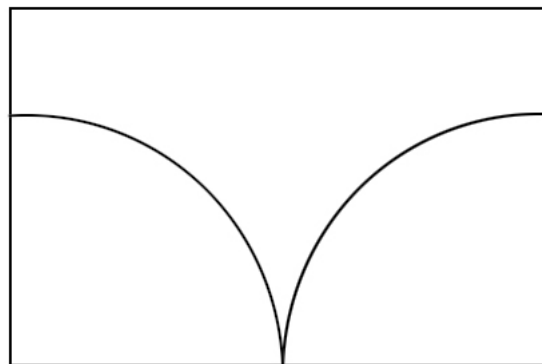


This path is the guide you will use to move the penny along as you take photographs.

### Step 2: Plan your penny's spacing.

You also need to plan the distance you will move the penny between photographs—the *spacing*. The distance you move the penny affects the animation's *timing*. *Timing*, in part, refers to the length of time it takes something to happen in an animation. *The more closely that an object is spaced between frames, the slower the object appears to move in the animation.*

**Note:** In many animated movies, images are played back at 24 frames per second (fps)—this is also known as the frame rate. Although other frame rates are sometimes used, in this unit you will use 24 fps.

Plan to shoot 24 photographs of the penny moving along the path. (If you played the animation at 24 fps, you'd have 1 second of animation.) You'll take 12 photographs of the penny moving along the downward drop and hitting the ground and 12 of the penny on the upward bounce.

For this first animation, you'll move the penny the same distance for each shot. With a pencil, lightly mark small dots at each point along the path where you'll move the penny.

## Step 3: Set up your camera.

Set up your camera on a tripod so that it squarely faces your white background and so that you can see the entire path you've drawn when you look through the camera. Depending on your tripod, you may be able to point the camera straight down at the table. If not, put the white paper on a wall, as shown below. (You'll need to use tape, wall putty, or another adhesive to hold the penny in place during each shot.)
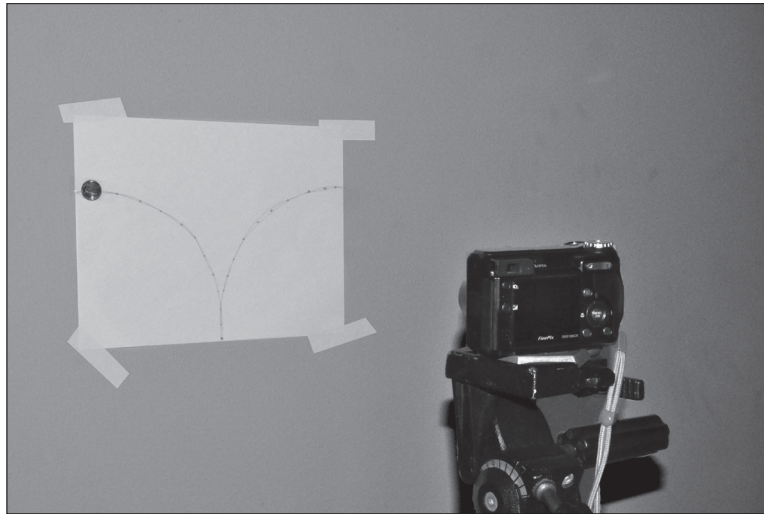


Place the penny at the top left side of the path and take a test photograph to make sure that everything looks okay.

## Step 4: Photograph the penny.

Have one team member be the cameraperson and another team member be responsible for moving the penny. Take a photograph of the penny at the top of the path you've drawn. Then move the penny to the first dot you've drawn and take another photograph. Move the penny again and repeat, until you have taken 24 photographs.

## Step 5: Create your animation.

Your teacher will show you how to import your photographs and use software to create an animation by playing your photographs sequentially. Create a loop of your animation, played at 24 fps, so the penny seems to bounce several times. (This will help you analyze the animation.)

## Step 6: Experiment with holds.

Next, you can try experimenting with "holding" frames. Animators will often "hold" an image for two frames—meaning that the same image will play for two frames. There are two reasons to use holds: to change the timing of the animation (more frames means that the object moves more slowly) and to reduce the amount of drawing that needs to be done (if an image is held for two frames, that's one less drawing to make!).

Experiment with holding some of your frames (by creating a duplicate frame of the image in the software program) to see how the timing changes.

## Step 7: Experiment with the frame rate.

You've been playing your animation at 24 fps. What would happen if you played it at 12 fps? The human eye needs to see at least 12 images per second in order for the brain to create the illusion of motion, so 12 fps is slowest frame rate you can use and still have the drawings look animated. (If there are fewer images per second, you'll feel like you're looking at one drawing following another rather than a continuous movement.)

If the software you are using allows you do to so, experiment with different frame rates. What does the animation look like when you play it at 12 fps vs. 24 fps?

# Second Animation

Now you'll learn more about timing and spacing by making a second animation. In this animation, you'll make the penny move differently than you did in your first animation.

### Step 8: Plan new movements for your penny.

Using the same background and path, plan to move your penny again. (Since you'll be drawing new dots, you might want to trace the path on a new sheet of paper.) You'll shoot the same number of photographs, but instead of moving the penny the same distance between shots, you'll move the penny a shorter distance at both the beginning and end of the "bounce" and a greater distance when the penny moves toward the "floor." Your penny's movement should look something like this:
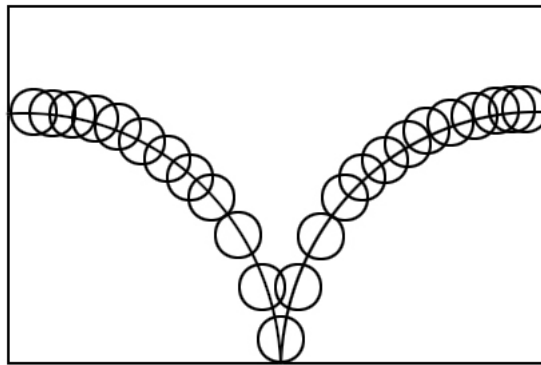


### Step 9: Photograph your penny.

Set up your camera again and follow the same procedure you used in the first animation. Switch roles so that other team members operate the camera and move the penny.

### Step 10: Create your animation.

Import your photographs and create your second animation. Note any differences between your first and second animations.

## 1A.3: Seeing the Principles of Animation at Work

**1. Show students a movie clip.**

Tell students that now they will learn more about the basic principles of animation. Give students **Handout 3: Principles of Animation #1**.

Play students one of the short movie clips that demonstrate the principles of animation. As students watch, highlight the characteristics of *squash and stretch*, *slow in* and *slow out*, *arcs*, and *timing*.

---

**Teacher's Notes: Demonstrating Analysis of an Animation Principle**

To highlight the use of these four principles, you can pause the clip, play it in slow motion at key moments, or use a dry-erase marker to sketch on the monitor. (If you can't use a dry-erase marker on your monitor, you can project the clip onto a white board or tracing paper and draw on those surfaces.)

- **To illustrate squash and stretch**, trace an object or body part squashing and then trace it stretching a few frames later.
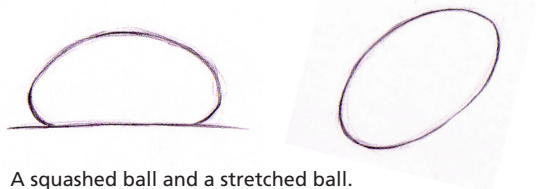
A squashed ball and a stretched ball.
Drawings by Brock Ramirez.

- **To illustrate slow in and slow out**, play the clip in slow motion to point out that, for example, a bouncing object moves more slowly near the top of the bounce. You can explain that this principle also refers to the fact that humans and animals (unlike machines or robots) do not "snap" into position; rather, we ease in and out of positions. Slow in and slow out keeps a character's motions from looking too abrupt.

  **Note:** It may be easier for students to identify this principle if you choose clips that show characters making big gestures or motions.

- **To show arcs**, draw points, frame by frame, showing a character's wrist or other body part as the character walks or moves. Then connect the points to show that there is an arc to the movement of the body part.
- **To demonstrate timing,** play the clip in slow motion and point out how different timing is used for certain objects and characters— for example, a heavy character might move more slowly than a lighter character.

---

**Teacher's Notes: Sample Analysis of Sleeping Beauty**

The following is an analysis of a four-minute clip from *Sleeping Beauty*, starting about eight minutes into the movie (when Maleficent appears in the castle):

- *Squash and Stretch:* The faces of the knights stretch as they recoil in surprise from Maleficent (9:35); the king's face squashes and stretches when he asks, "Then, she can undo this fearful curse?" (9:52); the faces and the fabric-covered bodies of the fairies squash and stretch throughout, sometimes subtly and sometimes more broadly; Merryweather's face and body squash and stretch dramatically when she says the word "hop-toad" near the end of the clip (11:43).
- *Slow In and Slow Out:* There are examples of this principle throughout, when characters move, but students may be able to see it most clearly when looking at Maleficent, whose movements are slightly slowed down and exaggerated for effect. Slow in and slow out is also clearly used when Flora (the fairy dressed in red) tells the king and queen not to despair (9:47).
- *Arcs:* Examples of arcs can be seen throughout the clip when characters move. One particularly clear example is when Maleficent raises and lowers her arms as she says, "Listen well, all of you" (9:00). Maleficent's hand movements, in general, move in clear arcs.
- *Timing:* The characters in the clip have different timing (move more slowly or quickly) that depends on their bodies, their personalities, and the action in the clip. For example, Maleficent moves relatively slowly and in a slightly exaggerated manner, appropriate for her status as a powerful magical being (and one who is pretending to be civil while actually being threatening). On the other hand, the fairies generally move more quickly (particularly their heads and hands) and with a "bouncy" motion befitting their size and personalities. The king and queen generally move more slowly and regally, but the queen moves quickly to pick up Aurora when she is threatened by Maleficent, and the King moves quickly to tell the guards to seize Maleficent.

**2. Have pairs analyze the use of one animation principle in a movie clip.**

Pair students and assign each pair one of the principles of animation from Handout 3.

Give students a few minutes to read the information about their assigned principle and then play the second short movie clip. Tell students that as they watch the clip, they should take notes on the following questions:

- How do the animators make use of the principle during this clip?
- What visual evidence can you point to? Make note of at least one specific moment during the clip.

Have students write their notes on Handout 3. If necessary, play the clip twice so that students can complete their analyses.

Give pairs a few minutes to discuss their analyses, come to a consensus about the use of the principle in the clip, and select one moment during the clip to use as evidence.

**3. Have students share their analyses.**

Have several pairs of students explain how the animators made use of their assigned principle. Cue the clip to the moment the pair has chosen and, if appropriate, have students sketch on the monitor with dry-erase markers to identify the visual evidence.

Once pairs have shared their analyses, ask:

- How does the use of these principles affect the animation?

  *Possible answers: Use of the principles of animation makes the animation more alive or believable for the viewers, engaging to watch, and visually appealing.*

- How do you think using these principles supports the telling of the story?

  *Possible answers: By making the world of the story seem more real and believable to viewers; by focusing the scene on the characters and action.*

## Handout 3:
# Principles of Animation #1

As with most other art forms, animation has a set of basic principles. Ollie Johnston and Frank Thomas, animators who worked for Disney, laid out 12 principles of animation in their book *The Illusion of Life: Disney Animation*.

These 12 principles incorporate the techniques that Disney animators used to create more lifelike, believable animations. Although the technology has changed since Walt Disney began making animations in the 1920s, these same principles still apply.

Below is a description of four of these principles. (You'll learn about the others later in the unit.) Your teacher will assign you and a partner one principle. Take notes on how the principle is used as you watch an animated movie clip.

## Squash and Stretch



A squashed ball.
Drawing by Brock Ramirez.

Think about a rubber ball bouncing on the ground. When the ball hits the ground, does it stay exactly the same shape? Although it happens so quickly you may not notice it, the ball "squashes" a little bit, compressing as it makes contact with the ground. Like the ball, many things in the world—both inanimate objects and living things, such as people and animals—change shape as they move in response to physical forces.



A stretched ball.
Drawing by Brock Ramirez.

Animators represent these physical changes by squashing and/or stretching the shapes of objects and characters as they move. Too much squashing and stretching can make the animation seem rubbery, while too little can make it seem wooden. It's important to know that when you use the squash-and-stretch principle, the volume of the object remains the same. That is, even though the ball changes shape when it hits the ground, its total size doesn't change.

***Notes:***

## Slow In and Slow Out

Think back to the penny animations that you created. In the second animation, the penny moved more slowly at the beginning and at the end of the bounce. This is one version of the principle of *slow in and slow out*—putting more frames at the beginning and the end of an action to make the movement appear slower at those times.

This principle is important because objects and people usually take some time to start and to stop moving and because the audience usually needs time to register the action taking place. *Slow in and slow out* can also keep animations from looking too robotic. However, as with most of these principles, you will find exceptions (i.e., there are some situations where it's better to have the action begin or end quickly).

*Notes:*

## Arcs

Think about the trajectory (or path) of a bouncing ball, or the arm of a baseball pitcher as it moves forward to deliver a pitch. Do these objects move in a straight line? Of course not! They move in arcs. Almost all natural movement takes place on a curved or circular path, as seen here in the picture of the pendulum swinging. Animators following this principle make sure that the movements in their animations follow these natural arcing paths. The exception is mechanical movement, such as that made by machines or robots.



Arc          Arc
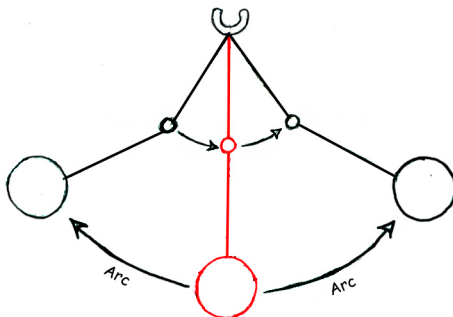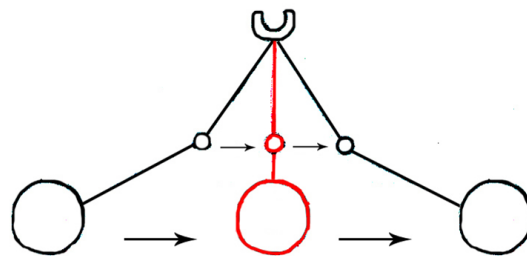
Wrong! The ropes shrink! Although this is an extreme example, similar problems commonly occur to varying degrees in animations that are not mindful of arcs of motion.

Drawings by Brock Ramirez

*Notes:*

# Timing

You already learned something about timing when you animated a penny. *Timing* refers to how quickly or slowly an action happens—for example, the length of time it takes for a ball to bounce. Appropriate timing can make an animation look more realistic—for example, a heavier object may take longer to begin moving and to stop moving than a lighter object would, just as in real life.

Timing also affects the pacing of a scene—if there are too many slow actions, a scene can drag or become boring (although there may be instances when an animator intentionally slows down a scene).

Timing can be affected by such factors as how much an object weighs and its placement in a scene. Timing can also be affected by a character's personality and body type (for example, a large man deep in thought will usually move more slowly than an excited young boy). During the animation process, timing is affected by spacing—the more closely spaced an object is from one frame to the next, and the more drawings there are of the object completing an action, the more slowly the object will seem to move.



How might the timing be different for these two characters, based on their body types?
Images courtesy of DreamWorks LLC.

*Notes:*

## 1A.4: Looking at the Elements of Art and Principles of Design

> **Teacher's Notes:**
> **Focusing on the Elements of Art and Principles of Design**
>
> Throughout the unit, students analyze how the elements of art and principles of design are used in animation, and they're assessed on how well they use them in their own animations.
>
> You may wish to have students focus on one or more specific elements or principles, particularly if there are areas in which students need to strengthen their skills and understanding. If so, select these areas of focus before beginning the activity.

**1. Review the elements of art and principles of design.**
Point out that animation is a visual art form and that successful animations effectively use the elements of art and principles of design just as successful paintings and drawings do. Explain that in addition to learning about the principles of animation, students will consider how animators make use of the elements of art and principles of design.

Give students **Handout 4: Elements of Art and Principles of Design**. Go over the terms on the handout and make sure that students are familiar with all the elements and principles.

**2. Have students analyze an animated movie clip.**
Replay one of the two animated movie clips that students have just seen. Tell students to take notes on how the elements of art and principles of design are used in the clip.

> **Note:** If students need more support, you can analyze one clip as a class before students analyze the other clip on their own. You can also have students analyze a still image rather than the whole clip. If you are focusing on specific elements or principles, have students analyze how these are used in the clip.

**3. Have students share their analyses with the class.**

> **Teacher's Notes: Sample Analysis of the Elements of Art and Principles of Design Used in *Sleeping Beauty***
>
> The following is an analysis of the same four-minute clip from *Sleeping Beauty* analyzed above.
>
> The elements of art and principles of design are used effectively in many ways in this clip. For example:
>
> • In the frames in which Maleficent's entire body is seen, the animators effectively use a nearly symmetrically balanced composition, with Maleficent in the center and the castle and townspeople receding behind her. This strong composition positions Maleficent as the dominant figure in the scene, emphasizing her power. Maleficent is also painted with darker values (except for her hands and face) and more intense hues than the castle and people behind her, which emphasizes her figure in the composition.
>
> • Nearly symmetrical balance is also used in a later scene (10:50) of the castle and townspeople.
>
> • Color is used in a variety of ways. For example, the bright, primary colors of the fairy godmothers' clothes contrast with Maleficent's almost all black outfit, reinforcing their status as "good" and hers as "evil." Later in the clip, red is used as the dominant color in the spinning wheel burning scene, emphasizing the drama of the scene.
>
> • The animators use contrast to create drama and emphasis during Merryweather's gift-giving (10:20) by having a shaft of light cross an almost black frame to reveal the sleeping form of Aurora. A shaft of light also illuminates the kings, queen, and fairy godmothers (10:40). In the spinning wheel burning scene, the red light of the fire contrasts with the blackness of the sky behind it.
>
> • The image of the pile of spinning wheels uses repetition of forms to create unity, while differences in size, color, and value (some of the wheels are illuminated while others are dark) provide variety.

**4. Introduce the weekly critique assignment.**

Distribute **Handout 5: Weekly Critique** and **Assessment Checklist 1: Weekly Critique**.

> **Note:** Give students extra copies of Handout 5 and the Assessment Checklist so that they can complete one handout and one assessment each week.

Explain that students will watch a 5–10-minute animation clip on their own, outside of class, each week and write a critique, using the questions on Handout 5. Explain that after each critique, students should fill out the Student Comments portion of the Assessment Checklist.

Point out the kinds of clips recommended for critique on Handout 5—clips using different forms of animation, and clips made in different countries and in other time periods. Tell students that they can find clips on television, on DVD, or online. Provide students with a list of links to animated clips online.

Discuss the different components of the critique on Handout 5: description, analysis and interpretation, and critique.

> **Note:** The critique is loosely based on the Feldman method of art criticism. For more information about the Feldman method, see *D/M/A Foundations in Visual Arts, Unit 1: Getting to Know You*.

**Teacher's Notes: Weekly Critique**

If students have completed *Foundations in Media and Digital Design: Audio & Video*, they will have experience with weekly critiques. If students are new to the weekly critique process, critique one clip together as a class. A sample critique of *My Neighbor Totoro* is included in the teacher's version of Handout 5.

*Critiquing Clips*

Students can see how animation has evolved by analyzing a clip from the early days of commercial animation, such as Disney's classic short *Steamboat Willie*. (See *Media & Resources* for more information about this short.) Watching older clips allows students to think about the evolution of the medium over time. In *Steamboat Willie*, for example, students can see that when Mickey's arms stretch out, their mass changes, and the character's movement looks rubbery. Students can also compare the way Mickey Mouse looks in *Steamboat Willie* to the way he looks in a later movie, such as *Fantasia*. It may be difficult for students to find these clips, so you may want to play one in class.

If students have difficulty finding clips from animations made in other countries, you may want to play one of these in class as well. The works of Hayao Miyazaki (*My Neighbor Totoro*, *Spirited Away*) are available on DVD and provide an excellent springboard for discussing similarities and differences between animations made in different cultures.

You can also use the weekly critique to compare how different animators tell the same story. For example, students can watch clips from the Disney movie *Alice in Wonderland* and Jan Svankmajer's *Alice* (which combines live-action and stop-motion animation), or from Disney's *The Little Mermaid* and Miyazaki's *Ponyo* (which is inspired by Hans Christian Andersen's *The Little Mermaid*).

*Logistics*
Playing clips in class will add additional time to the unit.

You can have small groups of students watch clips on their own or together and work on their critiques during class while they wait their turn to use the equipment.

*Critique Check-Ins*
Schedule one or two check-ins during the unit in which students can discuss their critiques. Collect and review students' written critiques and assessments after each check-in.

## Handout 4:
# Elements of Art and Principles of Design

Just as artists who work in other visual art forms do, animators use the *elements of art*—the components used to create works of art, such as line, color, and shape—and *principles of design*—concepts relating to how the elements of art are arranged, such as balance, contrast, and rhythm.

Throughout the unit, you will analyze the ways in which animators use the elements of art and principles of design in successful animations. Definitions and descriptions that you can use as you analyze the works are given below.

## Elements of Art

*Color:* The visual sensation dependent on the reflection or absorption of light from a given surface. The three characteristics of color are hue, value, and intensity.

*Form:* A three-dimensional object (such as a sphere or cube) or the illusion of three dimensions.

*Line:* The path made by a point moving in space. Lines can vary in width, length, curvature, color, and direction.

*Shape:* A two-dimensional area or plane that may be open or closed, free-form or geometric.

*Space:* The emptiness or open area between, around, above, below, or within objects. *Shapes* and *forms* are defined by the space around and within them. Conversely, *spaces* are defined by the shapes and forms around and within them.

*Texture:* The surface quality of materials, either actual (felt/tactile) or implied (visual).

*Value:* The lightness or darkness of a hue or neutral color (such as gray).

## Principles of Design

*Balance:* The arrangement of visual arts elements to create a feeling of stability or an equal distribution of visual "weight" in a work of art.

*Contrast:* The difference between two or more elements (e.g., value, color, texture) in a composition; the bringing together of dissimilar elements in a work of art; the degree of difference between the lightest and darkest parts of a picture.

*Dominance:* The emphasis of one aspect in relation to all other aspects of a design.
Emphasis: Special stress given to an element to make it stand out.

*Movement:* The principle of design dealing with the creation of action; a way of causing the eye of the viewer to travel within and across the boundary of a work of art.

*Repetition:* The recurrence of elements of art at regular intervals.

*Rhythm:* Intentional, regular repetition of design elements to achieve a specific effect or pattern.

*Subordination:* Making an element appear to hold secondary or lesser importance within a design or work of art.

*Unity:* The total visual effect of a composition, achieved by the careful blending of the elements of art and the principles of design.

*Variety:* A principle of design concerned with combining elements of art in different ways to create interest.

## Vocabulary for Critiquing Use of the Elements of Art

Terms you can use to describe different elements of art are given below.

### Line

- Descriptive (a line that depicts something in a drawing, helping viewers to understand what is shown)
- Expressive (a line that expresses a feeling)
- Implied (a line that is suggested but not explicitly drawn, such as the line created when one color ends and another begins)
- Curved, jagged, or straight
- Closed or open

You might also use descriptions such as *soft*, *hard*, or *smooth*.

### Shape (2-D)

- Positive (figure) or negative (ground)
- Geometric (perfectly straight or round) or organic (irregular; not perfectly straight or round)
- Closed or open

You might also use descriptions such as *large*, *small*, *wide*, *narrow*, *long*, or *short*.

### Form (3-D)

- Geometric or organic
- Closed or open

You might also use descriptions such as *large*, *small*, *wide*, *narrow*, *high*, *deep*, or *shallow*.

## Color

- Intensity: Low (dull) or high (bright)
- Value: Tint (the lighter range of a color, such as the color mixed with white or lightened with water); and shade (the darker range, such as the color mixed with black or dark gray)
- Expression: Warm (such as yellow, orange, and red); cool (such as blue, green, and violet); or neutral (such as gray, brown, and black)
- Hue: Primary (yellow, red, and blue); secondary (orange, green, and violet); or intermediate (between primary and secondary, such as yellow-orange and blue-green)

- Arrangements: Complementary (contrasting colors, those that are opposites on the color wheel); analogous (colors that are close together); or monochromatic (different values of the same color)

## Space

- Positive or negative
- Perspective in 2-D art: One-point, two-point, or three-point
- Placement in space to create depth in 2-D art: Low, high, or overlapping

## Texture

- Real or simulated
- Glossy or matte

You might also use descriptions such as *coarse*, *smooth*, *sharp*, *shiny*, *bumpy*, or *fuzzy*.

## Handout 5:
# Weekly Critique

Choose an animated clip to watch, analyze, and critique on your own each week.

## Choose Clips

By watching a variety of clips, you can see how professional animators use the principles of animation and the elements of art and principles of design. You can observe how the principles of animation are used in different forms of animation. You can also look for differences and similarities among the forms.

Choose a brief clip (no longer than 10 minutes) from an animated movie, TV show, or short. You might want to watch a clip online or on DVD so that you can play it more than once. Your teacher can give you suggestions for where to find clips online.

Choose at least one clip from each kind of animation listed below:

- Traditional hand-drawn 2-D animation, such as classic Disney movies (*Snow White*, *Cinderella*) or episodes from *Looney Tunes*
- Stop-motion animation, such as *Wallace and Gromit* or *The Nightmare Before Christmas*
- Computer-generated 3-D animation, such as *Kung Fu Panda* or *Up*

Try to include as many animations as possible from different time periods, countries, and cultures. For example, you might choose a clip from an animation made in another country, such as *Spirited Away*, made in Japan by Hayao Miyazaki.

## Describe, Analyze, Critique

Fill out the charts below for each clip. You can include drawings as well as text—for example, you might sketch out how the animators have used a principle of animation.

| THE CLIP | |
|---|---|
| Title of TV show, movie, or short | *My Neighbor Totoro* |
| Length of the clip and where in the animation it is found (e.g., "five-minute clip starting 15 minutes into the movie") | *Seven-minute clip starting at about 29 minutes into the movie* |
| Date and time you watch the clip | |
| Date the animation was made | *1988* |
| Form of animation (e.g., 2-D hand-drawn, computer-generated 3-D, stop-motion) | *2-D hand-drawn* |

| DESCRIPTION | |
|---|---|
| What story is told? | *The story is how Mei first meets Totoro.* |
| What action takes place during the clip? | *Mei sees a small white creature and follows it, chasing it under a house. She looks under the house and sees a second creature, this one blue. Mei follows the creatures into the forest and falls into a deep hole beneath a tree, where she finds a large, furry, sleeping creature. Mei climbs on the creature and talks to it, eventually deciding that its name is Totoro. Mei then falls asleep on top of Totoro.* |
| What do the characters look like, and how do they move? What are their personalities? How does the animation reinforce each character's personality? | *Mei is a curious, energetic little girl with an open and expressive face. She moves quickly, often jumping or running. The white and blue creatures are small and nervous. Their movements are somewhat clumsy—their bodies are large in proportion to their legs. Totoro is a large, furry creature who moves slowly.* |
| What does the world of the animation look like, and what is the mood like? (Dark and brooding? Happy and bright?) How do the colors and drawings convey the mood of the scene? | *The clip is set mostly in a natural environment—a yard and a forest—and the world seems to be bright and peaceful. The only building is a house. The landscape is lush, colored with saturated greens and blues, and there are many trees and other leafy plants. The house is made of wood and cement and is colored with subdued browns and grays.* |

| ANALYSIS AND INTERPRETATION | |
|---|---|
| How have the animators used the principles of animation? Describe at least one specific example. | *The animators use squash and stretch in the movement of the white creature as it walks. They use exaggeration when Totoro and Mei roar at one another—Mei's mouth opens far wider than a mouth could open in real life. The animators use staging effectively throughout the clip—they use color, light, and composition to draw the viewer's eye, keep the viewer engaged, and create a mood.* |
| How does the animation effectively use the elements of art and principles of design? Describe at least one specific example. | *At one moment in the clip when Mei looks through a square opening under the house, the contrast between the dark area beneath the house and the light area of the opening emphasizes Mei's face. Texture—of plants, fur, clothing, and other surfaces—is used effectively throughout the clip to create a believable, detailed world.* |
| How do the animation style and the visual world reflect the story being told? | *The visual world of the animation is created in a realistic, detailed, almost painterly style. The lushness of the environment reflects the fact that the movie's story is in part about the natural world and the spirits that live within it. The characters are drawn in a simple, streamlined style so that they can be exaggerated to show emotions and feelings more clearly. Totoro and the other creatures in particular are drawn in a style that reflects the fantastical nature of the story.* |
| How is the story or the look of the clip different from or similar to other clips you've watched? | *Answers will vary.* |

| CRITIQUE | |
|---|---|
| Was the animation successful? Why or why not? | *Answers will vary—here is one possible answer:* <br> *The animation is successful because it creates a believable world and characters, in a style appropriate for the story. The characters are appealing, and the world is beautiful and engaging for the viewers.* |
| Describe one thing that you liked about the animation, and why. | *One successful aspect of the animation is the depiction of the natural landscape—the trees and plants are so vivid and full of detail that it almost seems like you can reach out and touch them.* |
| Describe one thing you would change about the animation, and why. | *Students' answers will vary. They might suggest adding additional squash to a motion, or adding secondary action.* |

## Assessment Checklist 1:
# Weekly Critique

Use this checklist to help you plan and assess each of your weekly critiques of animated clips. Your teacher will use this checklist to help evaluate your work

| Requirements | Percentage of Total Grade | Comments | |
|---|---|---|---|
| **Description** | | Student Comments | Teacher Comments |
| Clearly describes the story and action that takes place during the clip. | **10%** | | |
| Clearly describes how the characters look and move. | **10%** | | |
| Clearly describes the world of the animation. | **10%** | | |
| **Analysis and Interpretation** | | | |
| Demonstrates understanding of the principles of animation by pointing to their use in one or more specific examples. | **15%** | | |
| Demonstrates understanding of the elements of art and principles of design by pointing to their use in one or more specific examples. | **15%** | | |
| Clearly explains how the visual world and style of the animation reflect the story. | **10%** | | |

### Critique

| | | | |
|---|---|---|---|
| Makes a convincing case for why the animation is or is not successful. | **10%** | | |
| Identifies convincing reasons why one element of the animation is successful. | **10%** | | |
| Identifies convincing reasons why one element of the animation could use improvement. | **10%** | | |
| **Total** | **100%** | | |

# Activity 1B: Follow the Bouncing Ball

Students get hands-on experience with animation by completing a classic animation task: animating a bouncing ball. Students create animations using both straight-ahead and pose-to-pose animation, and then animate the ball using 2-D software. As part of the process, students learn more about the squash-and-stretch principle of animation, and implement what they have learned about timing and spacing.

## Sequence

| | |
|---|---|
| **1B.1:** **Introduction to Straight-Ahead Animation** | Students are introduced to hand-drawn animation by using straight-ahead techniques to animate a bouncing ball. Students then create pencil tests of their work. |
| **1B.2:** **Introduction to Pose-to-Pose Animation** | Students use pose-to-pose animation techniques to complete another bouncing ball animation and then create new pencil tests. |
| **1B.3:** **Introduction to 2-D Computer Animation** | Students learn the basics of a 2-D animation software program and create a third animation of a bouncing ball, using the animation principles they have learned so far. |
| **1B.4:** **Introducing the Career Profile Project** | Students learn about careers related to the work they are doing in the unit and are introduced to the Career Profile project. Students conduct research on AME professionals whom they may want to profile. |

## Materials Needed

- Optional: Flipbooks made from the illustrations in **Appendix B: Flipbook Pages** (see *Advance Preparation*)
- Erasers
- Peg bars and punched animation paper or thin sheets of paper that are clipped or stapled together at the top and taped to students' desks
- Optional: Light tables
- **Handout 6: Bouncing Ball Straight-Ahead Animation**
- Optional: Students' copies of Handout 2
- Digital cameras or scanners

- Computers (ideally, 1 for each student)
- Software for creating pencil tests (see Advance Preparation)
- **Handout 7: Bouncing Ball Pose-to-Pose Animation**
- **Handout 8: The Critical Response Process**
- **Handout 9: Unit 1 Journal Assignments**
- Software for creating 2-D computer-generated animation (see *Advance Preparation*)
- Optional: Step-by-step instructions, how-to guides, or user manuals for the 2-D animation software
- **Handout 10: Unit 1 Career Information**
- **Handout 11: Career Profile Project**
- **Assessment Checklist 2: Career Profile Project**

## Advance Preparation

- Optional: Create three flipbooks using the pages provided in **Appendix B: Flipbook Pages:**
    - Make three copies of pages 1–17 and one copy of each remaining page.
    - Put together one set of pages 1–17, in order, and staple them on the left-hand side. This is flipbook #1.
    - Put together the second copy of pages 1–17, replacing pages 2, 4, 8, 11, 13, 15, and 17 with v2, v4, v8, v11, v15, and v17. Staple them on the left-hand side. This is flipbook #2.
    - Put together the third copy of pages 1–17, replacing pages 5, 8, 11, 13, 14, and 16 with a5, a8, a11, a13, a14, and a16. Staple them on the left-hand side. This is flipbook #3.
- Determine the equipment that you will have students use to draw their animations. Ideally, students will use peg bars and punched animation paper. However, students can also use sheets of animation paper that have been stapled or clipped together at the top and then taped to their desks. Light tables can make animation work easier but are not required.
- If students are creating computer-generated or stop-motion animations, determine the equipment they will need, such as drawing tablets or cameras.
- Before Activity 1B.1, become familiar with the technique of "rolling" or "flipping" drawings in order to check what an animation looks like. (See *Media & Resources* for links to tutorials.)
- Determine whether students will capture their drawings by scanning them or by taking digital photographs, and then select the appropriate software for creating their pencil tests. (See *Media & Resources* for software options.)
- Select software for creating 2-D computer-generated animations. (See *Media & Resources* for software options.) Depending on how you plan to instruct students in using the software, you may want to create or locate step-by-step instructions, how-to guides, or user manuals.

**RESOURCES**

# 1B.1: Introduction to Straight-Ahead Animation

**Note:** The bouncing ball animations in Activities 1B.1–1B.3 allow you to determine whether students understand the basic process of animation and the principles they've learned about, thereby providing a good opportunity for formative assessment.

**1. Optional: Show students flipbooks of a bouncing ball.**

Show students the three flipbooks you made. Pass them around so students can see the animations.

Ask:

- Are there any problems with the animations in any of the flipbooks?

  *Possible answers: There are no problems with flipbook #1. In flipbook #2, the ball changes shape. In flipbook #3, the ball skips around and has an unnatural motion.*

- What do you think caused these problems?

  *Possible answers: In flipbook #2, the animator did not keep the volume and mass of the ball consistent. In flipbook #3, the animator didn't keep a consistent arc of motion from frame to frame.*

- How can you avoid these kinds of problems in your own bouncing ball animation?

  *Possible answers: Students should be sure to maintain consistent volume and mass in the objects they animate (if the object changes shape, the mass should remain consistent), plan out an arc of motion, and maintain that arc throughout the animation.*

  **Note:** An additional activity you can have students complete is to take apart the pages of the flipbooks and then mix and match the different frames, seeing what new kinds of problems they can create in the animations.

**2. Have students use straight-ahead techniques to animate a bouncing ball.**
Give students erasers, the equipment they are using to draw their animations, and **Handout 6: Bouncing Ball Straight-Ahead Animation**. Show students how to put the paper on their pegs or have them tape the clipped-together papers to their desks.

Have students use straight-ahead techniques to draw an animation of a bouncing ball, following Steps 1–5 on Handout 6. As students work, teach them the techniques they need to use to create their animations:

- Working from the bottom sheet of paper to the top
- Numbering their drawings in order
- Looking at the underlying drawings as they work
- Using squash and stretch to create a feeling of weight and movement
- Maintaining a consistent volume while changing the ball's shape
- Maintaining correct proportions when the ball is not influenced by squash and stretch
- Using previously drawn frames as a guide to maintaining shape and volume in subsequent frames
- Using spacing to create effective timing (e.g., to slow the action at the top of the bounce)
- Rolling or flipping their drawings

Refer to **Appendix C: Notes on the Bouncing Ball Straight-Ahead Animation** as needed.

> **Note:** Encourage students to work relatively quickly and fluidly—straight-ahead animation is generally free-flowing. Students will create a more structured animation when they draw their pose-to-pose animations.

**Teacher's Notes: Technology Adaptation**

If you are having students create computer-generated animations (2-D or 3-D) for this activity, you can introduce the software and have students create a bouncing ball animation with it, using straight-ahead techniques. Make sure that students still learn about using squash-and-stretch techniques to create the feeling of weight and movement and that they learn about timing and spacing.

If students are creating stop-motion animations, you can have them animate a ball of clay. For example, they can have the ball hit a wall or other object and then "bounce back," which allows them to experiment with squash and stretch, timing, and spacing.

**3. Have students create a pencil test.**

Have students photograph or scan their drawings and import them into a computer.

---

**Note:** If scanning equipment or cameras are limited, you can stagger students' work, here and throughout the unit, by having some students work on the weekly critique or an assignment from **Appendix A: Additional Animation Exercises** while others capture their work.

---

Show students how to use the software to create their pencil tests. Have them create a loop in which the ball bounces several times.

**Teacher's Notes: Experimenting with Holds**

You can have students experiment with "holding" frames for two or even three or four frames at the top of the arc. This changes the timing of the animation to make the ball move more slowly at the top of the bounce.

If students think that holding a frame for four frames makes the timing more realistic, tell them that they should add another drawing to the animation, rather than holding a frame for that long (in general, drawings are held for no more than two frames).

Have students individually watch and analyze their pencil tests and answer the questions in Step 6 of Handout 6.

## Handout 6:
# Bouncing Ball Straight-Ahead Animation

## Straight-Ahead Animation and Pose-to-Pose Animation

Another principle of animation is called *straight-ahead action* and *pose-to-pose*, which refers to two different ways of creating animations. Both styles of animation can be useful, and some animators use a combination of the two. (Stop-motion animation uses only straight-ahead techniques.)

In *straight-ahead animation*, the animator works "straight ahead," drawing frames in sequential order until the scene is complete. This allows the animator to work in a free, creative style, but it can be difficult for the animator to maintain proportions and accuracy throughout.

In *pose-to-pose animation*, the animator first creates the most important drawings in the scene (called *key poses*), then goes on to create *extreme poses*, *breakdown poses*, and *inbetween poses*. This allows the animator to have better control over composition and timing.

Follow the steps below to draw an animation of a bouncing ball, using straight-ahead techniques. You'll draw the first frame, then the second frame, then the third frame, and so on, in sequential order.

## Step 1: Think about the path your ball will take.

For this animation, your ball will bounce in the same way that your penny bounced—starting at the left top side, dropping down, and then bouncing up to the top right side.

**Note:** If an animator were to create an animation of a bouncing ball, the ball would not bounce up to the same height after it hit the ground (because of friction and gravity). However, because you are going to create a loop of the bounce, the ball needs to reach the same height so that the loop looks right.

The path of your ball should look something like this:
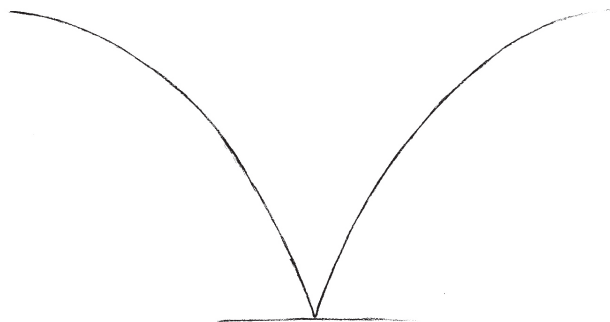


Drawing by Brock Ramirez

This will allow you to create a loop of the animation so that the ball appears to be bouncing. Draw the arc that represents the ball's path on a sheet of paper. You'll place the sheet of paper underneath each frame and use it as a guide for your drawing.

## Step 2: Plan for squash and stretch.

Before you start drawing, think about how you'll use the principle of squash and stretch in your animation. Sketch how the ball might look when it's squashed or stretched.
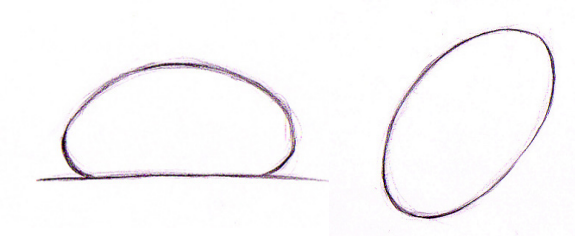
A squashed ball and a stretched ball.
Drawings by Brock Ramirez.

## Step 3: Think about timing.

Think about the principle of timing that you learned about when you animated the penny. The ball moves faster at the bottom of the bounce—when it nears the ground, and when it begins to bounce up again. The ball moves more slowly at the top of the bounce as the force of gravity overcomes the upward force of the bounce.

Remember, the more closely spaced the ball is from one drawing to the next, the more slowly the ball will appear to move. So you'll need to create more drawings, with the ball spaced more closely at the top of the bounce, in order to slow down the timing. (You can look back at the illustration in Step 8 of **Handout 2: Animating a Bouncing Penny** to see how this might look.)

## Step 4: Start drawing your animation.

Take a sheet of paper. (If you are working with a stack of sheets, begin with the sheet at the bottom of the stack—animators work from bottom to top so that they can flip the drawings and check the animation as they work.)

Draw the ball in the first frame of the animation. In one corner of the paper, label the drawing with the number "1."

Put a sheet of paper on top of your first drawing. You should be able to see the outline of the ball underneath. Draw your second frame. Remember to think about your spacing—closer together at the top and farther apart at the bottom. In one corner, label this drawing with the number "2." (Be sure to number each of your drawings from now on.)

Put another sheet of paper on top of your second drawing and draw your third frame. Continue to draw a few more frames.

## Step 5: Roll or flip your drawings as you work.

Once you've done four or five drawings, you can see what your animation looks like by rolling or flipping your work. (Your teacher will show you how.)

## Step 6: Do a pencil test.

Capture your drawings with a camera or scanner (your teacher will tell you which) and import them into a computer.

Use software to create a pencil test of your work—an animation of your drawings to see how well they work together. (Traditionally, animation studios did pencil tests before any work began on the final animations.)

You can experiment with holding frames to change the timing of the animation. If you feel the animation works better when a frame is held for three or more frames, you'll need to draw additional frames to fill in the gaps so that your finished animation has no holds that are more than two frames.

As you watch your pencil test, think about the following questions:

- How believable is the ball's bounce? How might you change the spacing and timing the next time you animate a ball?
- How smooth is the animation? Do you need to modify your drawing technique for your next animation?

# 1B.2: Introduction to Pose-to-Pose Animation

**1. Have students use pose-to-pose techniques to animate a bouncing ball.**
Give students Handout 7: Bouncing Ball Pose-to-Pose Animation.

Have students draw an animation of a bouncing ball using pose-to-pose techniques, following Steps 1–7 on Handout 7. As students work, teach them the techniques they need to use to create their animations:

- Identifying and drawing key poses
- Identifying and drawing extreme poses
- Identifying and drawing breakdown poses
- Drawing inbetweens
- Creating a chart to show timing

Students should incorporate any changes they identified as necessary when they watched their pencil tests.

> **Teacher's Notes: Technology Adaptation**
>
> If you are having students create computer-generated animations, have them use pose-to-pose techniques. Students should create key poses, extreme poses, and breakdown poses and can either create the inbetween frames themselves or use software to generate them (*tweening*). They can then practice manipulating the arc and timing of the action.
>
> If you are having students create stop-motion animations, note that stop-motion animation is done using straight-ahead techniques. You should be sure that students understand the principles of pose-to-pose and straight-ahead animation.

**2. Have students create a pencil test.**
Have students photograph or scan their drawings and import them into a computer.

> **Note:** If scanning equipment or cameras are limited, you can stagger students' work by having some students work on the weekly critique or an assignment from **Appendix A: Additional Animation Exercises** while others capture their work.

Have students create their pencil tests. Students can again experiment with holding frames.

**3. Introduce students to the Critical Response Process.**

> **Note:** If students have taken the *D/M/A Foundations in Visual Arts* course, they should be familiar with the Critical Response Process. In that case, this introduction can serve as a reminder.

Distribute **Handout 8: The Critical Response Process**. Explain to students that throughout the unit, they will critique one another's work using the Critical Response Process—a method for giving and receiving feedback that was developed by Liz Lerman, a choreographer, writer, performer, and educator. The process allows artists and other producers of creative works to request and receive feedback in a supportive, safe environment.

Have students read Handout 8. Go over the steps in the Critical Response Process, making sure that students understand their role as both giver and receiver of feedback.

**4. Have students critique animations.**

Have students show their pencils tests to the class and use the Critical Response Process to get feedback on their work.

> **Note:** If students need additional support in using the Critical Response Process, you can model the process with one student and his or her pencil test. If there isn't enough time to critique each student's animation as a whole class, have students work in teams to conduct a critique.

As the class follows the Critical Response Process, encourage students to ask and address the following questions:

- How believable is the ball's bounce?
- How smooth is the animation?
- How well does the animation make use of the principles of animation that you've learned?

> **Note:** If time allows, give students the opportunity to revise their animations based on the class's feedback.

**5. Discuss straight-ahead and pose-to-pose animation.**

Ask students:

- What were your experiences using straight-ahead and pose-to-pose animation? How were the two techniques different?

  *Possible answers: Straight-ahead animation seems freer, looser, or more spontaneous, while pose-to-pose animation, though more time-consuming, looks more polished or more carefully composed and helps in planning the animation.*

You may want to note that there are advantages and disadvantages to both methods and that both can be successfully used in animation. Animators will frequently use both methods in the same animation.

**6. Have students complete Journal 1.**

> **Note:** Journal 1 provides a good opportunity for formative assessment.

Give students **Handout 9: Unit 1 Journal Assignments**. Have students complete Journal 1 in or outside of class.

## Journal 1

Now that you've animated a rubber ball, think about how two other kinds of balls might look and behave in the same kind of animation:

- A small, hard, very bouncy ball
- A cannonball

Write a few sentences describing how the timing, spacing, arcs, and movement might be different for these two balls. Sketch the arc of each ball bouncing. Have each ball start at the top of the page and then bounce to a stop. (It should bounce two or three times, with the height of the ball decreasing with each bounce.) If you want, you can also create an animation of one of these bouncing balls.

## Handout 7:
# Bouncing Ball Pose-to-Pose Animation

Follow the steps below to draw an animation of a bouncing ball, using pose-to-pose techniques.

### Step 1: Draw the path your ball will follow.

Take a sheet of paper and draw the ball's path. You will use this sheet as a master sheet to guide your animation. The path will be the same as the path you used for your straight-ahead animation.

### Step 2: Identify and draw the key poses.

In animation, the *key poses* are the poses that, as the name suggests, are most important to the action—they show the beginning and end of the action and the most significant changes in the motion (such as changing directions). Key poses are the positions of the action that best define the object's movement. There are three key poses for a bouncing ball—the top of the bounce on the left-hand side, the bottom of the bounce in the middle, and the top of the bounce on the right-hand side:
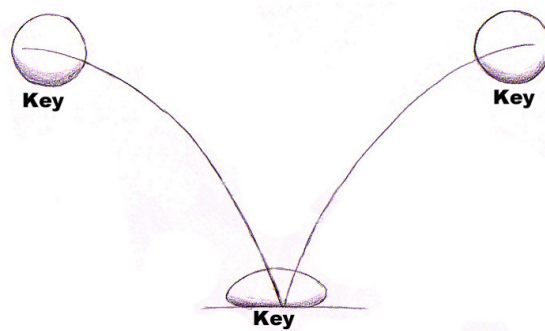


Drawing by Brock Ramirez

Note that the ball is squashed at the bottom of the bounce.

### Step 3: Identify and draw the extreme poses.

Extreme poses are those that show changes in motion or dramatic changes in shape (such as those showing squash and stretch) between the key poses. For a bouncing ball, there are two extreme poses—the moments of stretch just before and after the ball hits the ground.

> **Note:** Some animators use the terms *extreme pose* and *key pose* interchangeably.
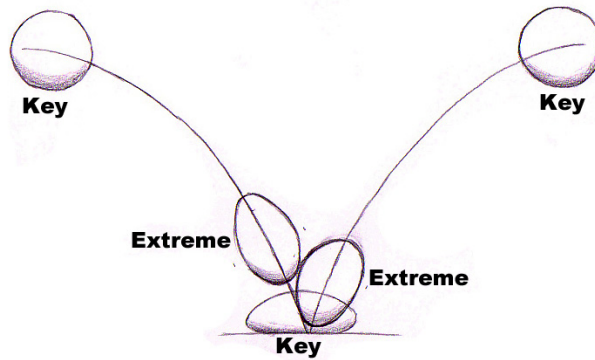
Drawing by Brock Ramirez

## Step 4: Identify and draw the breakdown poses.

*Breakdown poses*, also known as *passing poses*, are located either between two extreme poses, between two key poses, or between an extreme and a key pose. They show the path that the action should take (for example, the arcing path of the ball) and how shapes should retain their volume. Breakdowns are also important for creating the proper spacing and timing between keys and extremes. Draw two breakdown poses between the key poses on the left and the right sides of the arc:
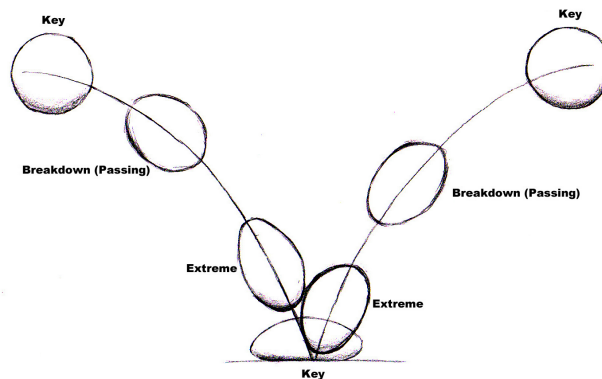


Drawing by Brock Ramirez

## Step 5: Identify and mark your inbetween poses.

*Inbetween poses*, or *inbetweens*, are any additional poses that need to be drawn to create the appropriate timing and spacing in the animation. These poses are drawn between key poses or between extreme and breakdown poses.

For the bouncing ball, one option is to have two inbetweens, one each near the top of the bounce on each side. These inbetweens will slow down the action at the top of the bounce, because more drawings equal slower timing. You can play around with the number of inbetweens to change the animation's spacing and timing.

Mark the place for your inbetweens with an "x." (Animators used to use x's on timing charts to indicate to people drawing the inbetweens—known as *inbetweeners*—how the inbetweens should be spaced.) Your master sheet of drawings is now complete.
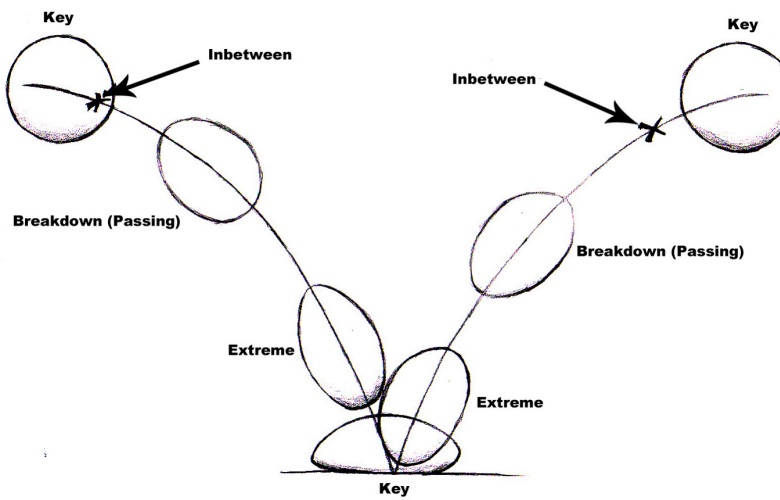


Drawing by Brock Ramirez

## Step 6: Create a chart to show the timing of the animation.

For pose-to-pose animation, you'll create a chart that is a visual representation of the spacing (and therefore the timing) of the animation. Start by numbering the drawings on your master sheet:

- The first ball on the left is your first frame, so, inside that ball, write the number "1."
- Your last frame is the ball on the right, so label that "9."
- The key pose at the bottom of the bounce is the middle pose, so label it "5."
- Number the rest of the drawings.

Your master sheet should look something like this:
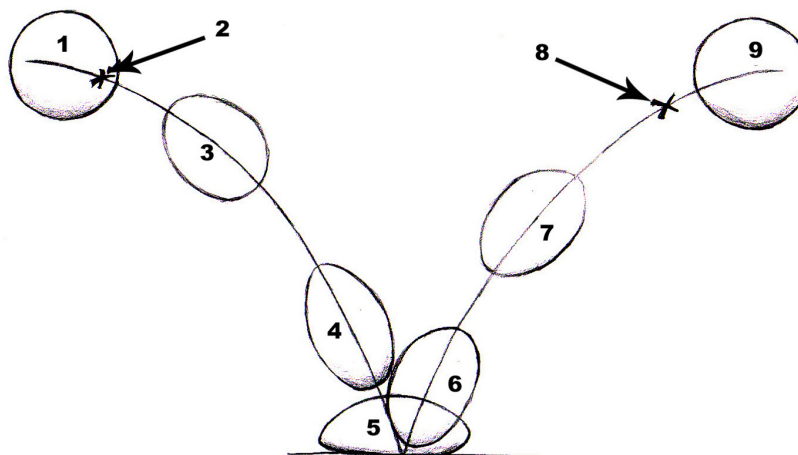


Drawing by Brock Ramirez

You can then use this information to create a chart showing the spacing and timing for the scene. First, draw a horizontal line, which represents time (you could also think of it as a flattened-out version of the arc you drew to guide your ball's bounce). Then draw two vertical lines at either end of the line, labeling them "1" and "9." These are your first and last frames. Draw a vertical line in the middle and label it "5." These are your three key frames.

The lines for key frames should be longer than the lines for other frames, and you may also want to circle the numbers of the key frames.
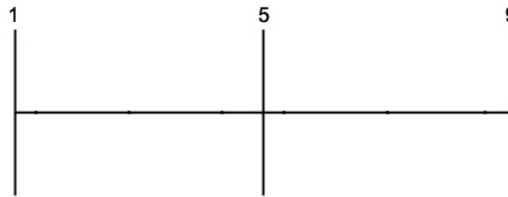
Draw and label vertical lines for your extreme poses. The spacing of the lines should reflect the spacing of the drawings in the animation. In this example, that means the extreme pose labeled "4" is farther away from the key pose "5" than the extreme pose labeled "6."
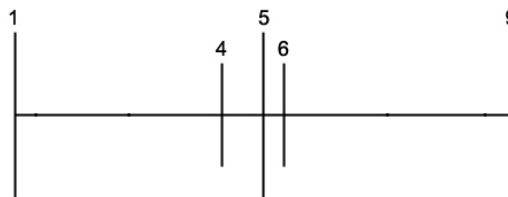
Next, draw and label vertical lines for your breakdown poses. Make sure the lines reflect the spacing of the drawings.
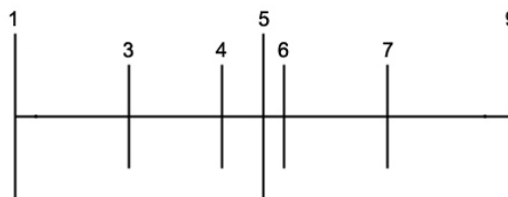
Now draw and label vertical lines for the inbetweens. Your chart should look like this:
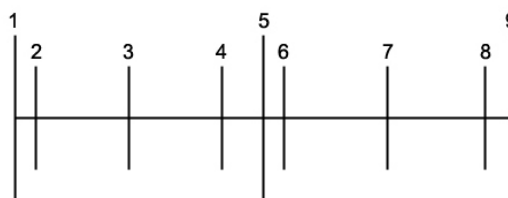
As you can see, the chart shows how closely together the drawings of the ball will be spaced on the different frames, and thus how the timing of the animation slows down at either end (when the ball is at the top of the arc). You can use this chart as a reference as you create your animation.

Animators often use timing charts to plan their drawings and to share information about timing in a simple way with others who may be working on the animation.

## Step 7: Do a pencil test.

Use the techniques you've learned to do a pencil test of your animation, creating a loop of the bouncing ball. You can experiment with holding frames to play with the timing of your animation.

**Handout 8:**
# The Critical Response Process

There are many different ways to give and receive feedback. One method that artists, performers, and other creators sometimes use is the Critical Response Process, which creates a safe and supportive environment in which to receive feedback on completed work or work in progress. You will use this process throughout the course with your classmates.

## Steps in the Critical Response Process

The Critical Response Process comprises three key steps:

- Audience members comment on something interesting they notice in the work. These comments should not judge or criticize the work. (For example, as you look at the work, think about what your find stimulating, surprising, memorable, touching, or meaningful for you.)
- The creator(s) asks the audience open-ended questions about something specific in the work. (For example, a creator wouldn't ask, "Do you like the way I've used squash and stretch in my animation?" but would ask instead, "What did you think about the use of squash and stretch in my animation?")
- The audience asks neutral (i.e., judgment-free) questions of the creator. (For example, the audience doesn't ask, "Why is your timing so slow at the bottom of the bounce?" but rather, "What were you trying to achieve with the use of timing in your animation?")

As you provide feedback, try to start sentences with phrases such as the following:

- I notice . . .
- I'm curious about . . .
- I'm interested in . . .
- I wonder . . .

## Handout 9:
# Unit 1 Journal Assignments

## Journal 1

Now that you've animated a rubber ball, think about how two other kinds of balls might look and behave in the same kind of animation:

- A small, hard, very bouncy ball
- A cannonball

Write a few sentences describing how the timing, spacing, arcs, and movement might be different for these two balls. Sketch the arc of each ball bouncing. Have each ball start at the top of the page and then bounce to a stop. (It should bounce two or three times, with the height of the ball decreasing with each bounce.) If you want, you can also create an animation of one of these bouncing balls.

## Journal 2

Make a list of two or three short stories, fairy tales, or myths that you really like. Write your answers to the following questions:

- Which of these stories do you think would make a good animated movie? Why?
- What about this story makes it a good candidate for animation?

## Journal 3

Look at Steps 2 and 3 on Handout 12 and use these questions as a guide to help you choose a scene and a moment to focus on. Write a paragraph about why you have chosen this scene and this moment. Be prepared to discuss your choices with a classmate.

## Journal 4

Conduct research on a visual aspect of your character. For example, if your character is in a story from an earlier time period, research the clothing worn at that time. If your character is an animal, find out how that animal looks and moves. Print or copy images to use as a reference as you work on your character design, and then add these images to your journal.

## Journal 5

If there is an important object that your character interacts with during the scene you've chosen, you'll need to design that object.

Create a design for the object, drawing it from all angles, as you did with your character. (If there's no object in the scene, you can design another object that's important in the story, even if it is not in your scene.) Make sure that the object is drawn in the same style as your character.

## Journal 6

Reflect on your work during this unit by writing about the following questions:

- What did you learn about the process of adapting a story for animation?
- What's the most important thing you learned about creating successful animations?
- What did you find most surprising about the animation process?
- What was your favorite part of the unit project to work on, and why?
- What would you do differently if you were to do this project again?

## 1B.3: Introduction to 2-D Computer Animation

**1. Show students basic 2-D computer animation techniques.**
Have students work individually (or, if necessary, in pairs) at a computer. Show them how to use the software to create basic animations, covering skills such as the following:

- Creating and saving files
- Using drawing tools
- Using tools to create shapes
- Using tools to move or manipulate shapes
- Locating and using the timeline
- Creating and working with layers
- Creating and editing key frames
- "Onion skinning"
- Animating frame by frame
- Having the software do tweening
- Exporting animations

> **Note:** This is a good time to distribute any step-by-step instructions, how-to guides, or user manuals about the 2-D animation software that you prepared or located for students.

**2. Have students create a bouncing ball animation.**
Students can create a single bounce, as they've done by hand, or they can have the ball bounce to a stop over the course of three or more bounces. Remind students to incorporate the principles of animation: timing and spacing, arcs, slow in and slow out, and squash and stretch. Help students troubleshoot any problems they encounter.

**3. Look at students' animations.**
Have students show their pencil tests to the class and use the Critical Response Process to get feedback on their work.

> **Note:** If there isn't time to critique each student's animation as a whole class, have students work in teams to conduct critiques.

Tell students that their feedback should also touch on the following questions:

- How believable is the ball's bounce?
- How smooth is the animation?
- How well does the animation make use of the principles of animation that you've learned?
- What changes could be made to improve the animation?

> **Note:** If time allows, give students the opportunity to revise their animations based on the feedback they receive.

**4. Have the class think about the processes of animation.**

Have students reflect on computer-generated and pencil-and-paper animation. Ask:

- What are the similarities between 2-D computer-generated and pencil-and-paper animation?

  *Possible answers: The process is very similar—in both, frames of drawings are created and played together to create the illusion of motion. Both kinds of animation use the concepts of key frames and inbetweens. The basic principles of animation, such as squash and stretch, apply to both forms.*

- How are they different?

  *Possible answers: Computer-generated animation allows animators to have the computer create inbetween poses, which can speed up the process. The same shapes can easily be used in multiple frames, which makes it easy to maintain consistency. However, if not handled correctly, animations can appear lifeless. Software allows animators freedom to change animations and to alter objects, although it also requires extra time to learn how to use the technology.*

- Why do you think it might be useful to learn hand-drawn animation using pencil and paper, even though computer-generated animation is most commonly used to make animated movies?

  *Possible answers: Making animations with pencil and paper allows you to learn the fundamentals of animation without the additional task of learning technology at the same time; it can help you understand the principles driving the processes and tools within the software, making the transition to computer animation easier; it gives you the opportunity to see how animation has been practiced since the beginning of the form; it can provide an immediacy of experience and feedback; it helps you focus on the details of the animation as well as on the drawing, which is an important skill no matter which medium you use to create animations.*

## 1B.4: Introducing the Career Profile Project

> **Note:** If students have taken *D/M/A Foundations in Media and Digital Design: Audio & Video* and completed the Career Profile project during that unit, the project is optional here. However, it is recommended that you still discuss animation careers with students.

**1. Discuss animation careers with students.**

Give students **Handout 10: Unit 1 Career Information**, **Handout 11: Career Profile Project**, and **Assessment Checklist 2: Career Profile Project**. Have students read Handout 10. Ask the following questions:

- How is the work that you have engaged in so far during this unit similar to the kinds of work done in the careers mentioned in the handout?
- Which career is most interesting to you? Why?

**2. Introduce the Career Profile project.**

Go over the information on Handout 11 and Assessment Checklist 2 with students and answer any questions they have.

Tell students when they will complete work on the project and present their career profiles to other students.

> **Note:** See *Foundations in Media and Digital Design: Animation & Game Design, Unit 2: Telling Stories with Moving Images* for more information about students' presentation of their career profiles.

**3. Have students research AME professionals.**

Have students conduct Internet research on the AME professionals they are thinking about profiling, using Step 1 of Handout 11 as a guide.

Talk with each student about the professional whose career they are planning to profile and make sure that students will be able to locate enough information about that person to complete the project successfully.

> **Teacher's Notes: Interviewing AME Professionals**
>
> You may want to encourage students to contact and interview their chosen professional. This will work best for people that students actually know or for professionals who aren't yet well known and are therefore more likely to participate. If students need information about interviewing, you can give them **Appendix D: Interviewing Techniques**.

Students should continue to work on their research during Units 1 and 2.

---

**Note:** Plan to check in with students on their progress several times over the course of Units 1 and 2.

---

**4. Have students complete Journal 2 in class or as a homework assignment.**

### Journal 2

Make a list of two or three short stories, fairy tales, or myths that you really like. Write your answers to the following questions:

- Which of these stories do you think would make a good animated movie? Why?
- What about this story makes it a good candidate for animation?

## Handout 10:
# Unit 1 Career Information

## Range of Careers Related to Unit 1

Below are some of the AME careers that make use of the skills you are learning in Unit 1:

- **Animation Supervisor**
- Art Director
- Compositor
- Director
- Editor
- Effects (FX) Artist/FX Animator
- Layout Artist
- Lead Animator
- **Lighter**

- Matte Painter/Digital Matte Painter
- Modeler
- Production Designer
- Rigger
- Set Dresser
- **Storyboard Assistant**
- Texture Painter/Surfacing Artist
- Visual Effects Supervisor

## Key Careers

Three key AME careers that make use of the skills that you are learning in Unit 1 are *storyboard assistant*, *animation supervisor*, and *lighter*.

## Storyboard Assistant

### Job Description

The storyboard assistant, also sometimes called the *production assistant for the storyboard department*, helps storyboard artists illustrate a plan for a live-action movie or animation on storyboard panels. *Storyboards* are panels of drawings that visualize the story and convey the director's vision. They communicate characters' emotions, show actions and camera movements, and keep continuity between shots. On movies, storyboard artists work closely with the director, cinematographer, and creative director. In advertising and video games, storyboard artists work with art directors and creative directors.

The storyboard assistant cleans up or fills in partially completed storyboard panels created by storyboard artists. Storyboard assistants must be able to follow artists' styles.

Because animation is expensive and time-consuming, creating an early outline that is close to final is important. Storyboard assistants scan the panels into a computer program that is used to produce the first working version of a film, called the *story reel* or *animatic*. Storyboard assistants perform any other tasks needed by the department. As deadlines near, they may need to work long hours.

### Skills

Storyboard assistants need to have excellent drawing skills, be able to sketch figures and backgrounds, and have an understanding of perspective and composition. They should have good computer skills and know how to use relevant software. As assistants, they are expected to take direction from the storyboard artist. They also need to be able to communicate clearly, work well as part of a team, and also

work independently to complete assignments in a timely manner.

Storyboard assistants may sometimes work on confidential projects, so trustworthiness and good judgment are critical. Maintaining trust is important in order to build good working relationships, which may lead to job advancement.

### Pathway
There are no formal requirements to become a storyboard assistant (although some companies require four-year art degrees even for entry-level positions). A candidate with passion and a portfolio demonstrating strong drawing skills can sometimes land a job. Most storyboard assistants have formal training in art, filmmaking, or animation. Technical artistic skills and an understanding of storytelling and film theory are ideal.

Storyboard assistant, like other production assistants, is an entry-level job. Storyboard assistants may go on to be storyboard artists (a position that typically requires at least two years of experience) or to work in other areas of movie production.

## Animation Supervisor
### Job Description
Animation supervisors oversee a team of animators. They may work on 2-D drawn, 2-D computer-generated (CG), or 3-D CG projects for animated or live-action feature films, video games, or the Web. Animation supervisors are more common on larger projects with many animators (such as feature films).

Animation supervisors set the creative direction of the team. They work closely with the art director or director, the Visual Design/Art Department (which develops the overall style and design of the environments and characters), and other departments to understand the vision for the project, which they then communicate to their team.

An animator working on CG projects is like a puppeteer. On 3-D CG projects, animators follow the final layout and voice recordings for each scene and then manipulate 3-D computer models of the characters (already built and rigged with digital joints) to create a movable skeleton. On 2-D CG projects, animators compose digital drawings and position them in a sequence.

Animation supervisors oversee the completion of the project. They approve or reject scenes from team members and are responsible for quality control, making sure that all work is "on model" (done in the correct style) and setting the standard for the team's work. They make sure that their team meets all deadlines. In addition, animation supervisors solve creative and technical problems. They may also animate their own shots in addition to overseeing others' work. They communicate with departments working on other aspects of production, such as layout and lighting.

### Skills
The work of an animator requires creative and artistic skills, such as understanding perspective, movement, and composition, and the ability to draw in a variety of styles: cartoon-like or realistic, fluid or mechanical. Animation supervisors working on CG animation must also have strong technical skills and should be familiar with the most current 2-D and 3-D art and animation software (such as Autodesk®

Maya®, Autodesk 3ds Max®, Autodesk MotionBuilder®, Adobe® Photoshop®, Adobe Flash®, and CelAction™).

Leadership skills are essential, including the ability to manage work flow, communicate clearly, and motivate others. Animation supervisors must also be collaborative workers.

### Pathway

A degree in animation or computer science is preferred, though not required. A background in drawing and/or acting is also a plus. Many jobs require an animation supervisor to first work as a character artist or animator for several years in order to demonstrate technical ability. Employers also look for past experience managing a team.

Most animation supervisors work their way up, first as a junior animator or assistant and then as an animator, finally becoming an animation supervisor. Sometimes their initial experience is in another related area, such as character rigging.

Experience and demonstration of talent are the most important components of job growth. All animators produce examples of their work, called show reels, that they use to demonstrate their talents to prospective employers. As in many parts of the entertainment industry, jobs are often found through personal recommendations and informal networks of colleagues, so building a reputation for good work is very important.

## Lighter

### Job Description

The lighter, also known as a *lighting technical director* or *lighting animator*, is responsible for adding light to a scene, adding realism, and setting the mood and tone. Lighters work in animated movies (and live-action movies that use special effects or animation), TV programs and commercials, and video games and other interactive media. At some studios and on smaller projects, lighting might be done by technical directors, generalists who might perform other jobs, such as *modeling* (creating 3-D skeletons of characters and environments on the computer), *shading* (changing colors based on their angle toward the light), and rendering (turning computer data into a final image).

The job of a lighter is much like that of a cinematographer or director of photography. A lighter must understand the ways that light behaves in the natural world, such as how light reflects off water. Lighters use light to help tell the story by indicating important events, such as a change in the time of day or the weather. Through light, they communicate the style and "look" of the film and maintain continuity between shots. When working on a live-action film, lighters also make sure that the light and shadow match up between the live and the animated portions of the scene.

To light a scene, lighters use a computer animation program to place *key light* (which provides the main illumination), *fill light* (which softens and extends), and *back light* (which creates a bright line around the object). Lighters may also use scripts (created with computer programming languages that are designed to allow manipulation of software) to automate the process, especially to solve a problem or to speed up work.

### Skills

A solid working knowledge of many computer software packages is very important. Lighters must know computer animation packages, such as Audodesk Maya or Audodesk 3ds Max, as well as rendering programs, such as Pixar RenderMan®. It's also useful to know compositing programs. To complement their technical skills, lighters should also have a strong artistic sense and an understanding of the basic principles of lighting used in photography and film.

Lighters need to be able to work both as part of a team and independently on assignments. They should be organized and able to complete tasks under a deadline.

### Pathway

Because the position combines artistic and technical skills, lighters generally hold degrees in many different disciplines, including art, photography, computer graphics, animation, computer science, engineering, math, and physics. People with a background in photography can excel as lighters. While there are junior-level positions in lighting, there are fewer entry-level positions. Many lighters first work in other departments. Lighters may also transition from more traditional lighting work on films or in the theater.

Lighters might move from being junior lighters to lighting supervisors. Some may eventually move on to become VX (visual effects) supervisors. Experience and talent are the most important criteria for moving forward. As in other animation careers, to showcase their technical skills, lighters should produce a lighting reel with examples of both CG-only scenes and CG integrated with live-action shots.

## Handout 11:
# Career Profile Project

What's it really like to have a career working in the AME industry? What education and training path gets you there? And what does the work of a talented AME professional look like?

For this project, you'll answer these questions by focusing on a successful professional who works in audio, video, animation, or gaming. You'll research the professional's career, education, and training, and analyze a clip from a production that this person has worked on. Your final step will be to present what you've learned to your classmates.

## Step 1: Choose an AME professional.

Pick an AME field that you are interested in, such as audio, video, animation, or gaming, and select a professional working in that field. You can take one of three approaches to choosing this person:

- **Think of a media production that you like** (e.g., a movie or game) and choose someone who worked on it—the director, animator, lead artist, cinematographer, level designer, or producer.
- C**hoose a professional whose work you admire.** Be sure to choose someone who works on media production, rather than a performer.
- **Choose someone you know personally or someone in the community** who works in this field.

Start with two or three professionals and conduct research to see how much information you can find—work samples, education and career paths, or interviews. Check to see if there are Web sites with clips of their work. (This is especially important for gaming and animation, since it can be hard to pick out an individual's contribution to finished games and animated movies.)

Narrow your choice to one professional by asking yourself the following:

- Does this professional work on media productions that I admire and want to watch, play, or listen to?
- Is there enough information available about this professional's career for me to complete the project?
- Has the professional had an interesting or instructive career path?

## Step 2: Find out about the professional's education and training.

Look online or in books or magazines to find out:

- What college (if any) did this person attend?
- What other training has this person pursued (e.g., technical training)?

Write a short paragraph about your professional's education and training.

## Step 3: Find out about the professional's career path.

Conduct research to learn about the path your professional has taken:

- How did your professional begin his or her career?
- What jobs or education has your professional taken or completed to get to his or her current position? Does your professional have further work or career goals?
- What media productions has your professional worked on, and what role did he or she play on each? List them in chronological order.
- Has your professional been interviewed or has he or she written about what it's like to work in this field? If so, what has your professional said?

Write a paragraph describing your professional's career path. Create a timeline that includes the following:

- Major career milestones
- Media productions the professional worked on

## Step 4: Analyze a media production.

Choose a successful media production that your professional has worked on. Try to find a good example of your professional's contribution—for example, an animator or gaming professional's reel or a scene with a character designed by your professional.

Analyze a short (10-minute or less) clip from the production:

- What makes this production successful? What visual and/or audio elements work well? What principles (such as the principles of animation or cinematography) are used effectively?
- How does the production make effective use of the elements of art and principles of design? (Disregard this question if you are analyzing an audio production.)
- What role did your professional play in contributing to the success of the production?
- Is there a particular style that can be attributed to your professional? (For example, some animators have a clearly identifiable style.) How is that style expressed in this work?

Write a paragraph analyzing the clip you've selected.

## Step 5: Share your profile with your classmates.

Share what you've learned with your classmates and learn about the professionals they profiled.

## Assessment Checklist 2:
# Career Profile Project

Use this checklist to help you plan and assess your project. Make sure that you include all the required components. Your teacher will use this checklist to help evaluate your work.

| Requirements | Percentage of Total Grade | Comments | |
|---|---|---|---|
| **Written Career Profile** | | Student Comments | Teacher Comments |
| Describes AME professional's education and training background. | **20%** | | |
| Describes how the professional's career began and the career path that led to his or her current position. | **20%** | | |
| Lists the media productions the professional has worked on and the role that she or he played on each. | **10%** | | |
| Includes a timeline of major career milestones and media productions. | **15%** | | |
| Includes an analysis of a clip from one of the professional's media productions, pointing to visual and/or audio elements that contribute to the work's success. | **20%** | | |
| Describes the role the professional played in making the media production successful. | **15%** | | |
| **Total** | **100%** | | |

| Requirements | Percentage of Total Grade | Comments | |
|---|---|---|---|
| **Career Profile Presentation** | | **Student Comments** | **Teacher Comments** |
| Clearly outlines the AME professional's education and training. | **30%** | | |
| Succinctly describes the professional's career path. | **30%** | | |
| Describes and analyzes a media production and explains the professional's role in its creation. | **30%** | | |
| Successfully addresses the audience's questions. | **10%** | | |
| **Total** | **100%** | | |

# Part 2: Finding the Right Story

Students begin work on their unit project. They select a story, choose a scene from the story and a moment from that scene, and design one of the main characters. Students then create turnaround sheets, character studies, model sheets, and a simplified character design to animate.

Students discuss their work in review groups, small teams that meet throughout the unit to provide feedback on team members' unit projects. To more fully understand the techniques and principles of animation, students learn about and practice drawing walk cycles.

## Length
**15 50-minute sessions**

## Activity 2A: Developing the Story

Students select a story and choose a scene and a moment for their unit project.

### Sequence

| | |
|---|---|
| **2A.1:**<br>**Choosing a Story** | Students are introduced to the unit project and watch a clip from an animated movie based on a fairy tale, myth, folktale, or short story. Students conduct research and choose the story for their unit project. |
| **2A.2:**<br>**Choosing a Scene and a Moment** | Students select a scene from their story and choose one moment from that scene to animate for their unit project. |

### Materials Needed

- Short clip of an animated movie based on a fairy tale, myth, or short story (see *Advance Preparation*)
- **Handout 12: Unit 1 Project Description**
- **Assessment Checklist 3: Unit Project—Character Design**
- Computers with Internet access
- Selection of fairy tales, folktales, myths, and short stories (see *Advance Preparation*)
- **Handout 13: Story Description**
- **Handout 14: About Review Groups**
- **Assessment Checklist 4: Unit Project—Review Group**
- **Handout 15: Scene and Moment Worksheet**

## Advance Preparation

- Select a short clip from an animated movie that retells a fairy tale, myth, folktale, or short story. See *Media & Resources* for suggestions.
- Work with an ELA teacher to provide an interesting selection of short stories, myths, folklore, and/or narrative poems for students to read and choose from. Decide whether students will read (or listen to) the stories in your class, in ELA class, or on their own. Set aside additional time if students are reading or listening to stories during your class time.
- If having students select stories is too challenging or if time is limited, you can pre-select one story for the class and have students focus on the same scene and moment. You can also have students choose from among three or four stories that you've selected.

## 2A.1: Choosing a Story

**1. Play the animated movie clip.**
Play the clip from an animated movie based on a fairy tale, myth, or short story. As students watch, have them pay attention to two things:

- The way that animation is used to tell the story
- The style of the animation

If necessary, play the clip twice.

**2. Discuss the clip with the class.**
Ask students:

- Why do you think the makers of this movie thought that the story was a good choice to make into an animated movie?
- What characteristics might make any story a good choice for turning into an animated movie?

  *Possible answers: The storyline is fun, exciting, or action-packed; the story has a clear arc (beginning, middle, and end); the characters are well developed and would be engaging to an audience; the story is popular and many people might want to watch it; elements of the story could benefit from the visual freedom of animation (dragons, life on another world, magical transformations, etc.).*

  **Note:** Emphasize to students that the final reason (story elements that could benefit from the visual freedom of animation) is crucial and is something they should consider as they choose their own story.

- In what style is the animation drawn (for example, is it exaggerated, realistic, impressionistic, anime-like)? How do you think the style of the animation supports the story that is told?

**3. Introduce the unit project.**

Give students **Handout 12: Unit 1 Project Description** and **Assessment Checklist 3: Unit Project—Character Design**. Go over the project and answer any questions.

**Note:** Students will receive assessments related to the other components of the unit project later in the unit.

**4. Have students discuss and get feedback on story ideas from Journal 2.**

Have several students share their Journal 2 responses about a story they want to turn into an animated film. Have the class discuss these story possibilities. Ask:

- Do you think this story would be a good choice for making into an animation? Why or why not?
- Do the story choices that students shared give you new ideas about a story that you think would make a good animated movie?

**5. Have students choose a story.**

Have students use Step 1 on Handout 12 to guide them as they choose a story for their unit project. They can use the story that they wrote about for Journal 2 or conduct research to find a different story.

Have students read stories and conduct research as necessary, looking at the books you've provided, searching online, and visiting the library.

**Note:** Remind students that if they choose a story that has already been made into an animated movie, such as *Snow White*, they need to transform the story in some other way, such as setting it in a new context or culture.

**6. Have students write about their stories.**

Distribute **Handout 13: Story Description** and have students complete it.

**7. Discuss review groups.**

Divide the class into teams of three or four and tell students that these are their review groups, which they will meet in to discuss their unit projects. Review groups provide a supportive environment for giving and receiving feedback.

Give students **Handout 14: About Review Groups**. Have students look over the handout, paying particular attention to the tips for givers and receivers of feedback. Ask:

- How should someone talk and act when they need to point out a problem or make a criticism about your work?

Write students' responses on chart paper and post it in the classroom.

> **Note:** Tell students that they will refer to the questions on Handout 14 throughout the unit as they conduct critiques.

**8. Have review groups discuss story choice.**
In their review groups, have students share their story choices. Teammates should give feedback on the story choice and raise any concerns about challenges the student might face in animating a moment from this story. Have review groups discuss how each teammate's story might be made into an animation.

> **Note:** Talk with each student about the story that he or she is planning to use for the unit project, and read students' completed copies of Handout 13 to make sure that the story is a good fit and won't be too difficult to animate.

Give students copies of **Assessment Checklist 4: Unit Project—Review Group**. Have students assess their own and their team members' work.

> **Note:** Students will use Assessment 4 again later in the unit.

**9. Have students complete Journal 3 in class or outside of class.**

## Journal 3

Look at Steps 2 and 3 on Handout 12 and use these questions as a guide to help you choose a scene and a moment to focus on. Write a paragraph about why you have chosen this scene and this moment. Be prepared to discuss your choices with a classmate.

## Handout 12:
# Unit 1 Project Description

What kind of story makes a good animated movie? How exactly do you turn a written story into an animation? How can you convince others to believe in a story that you're passionate about?

For your unit project, you will take on the role of an employee in an animation studio who has been given the task of coming up with an idea for a new animated movie.

You will choose a short work of fiction that you think would make a good animated movie. You'll design a character, create a storyboard, and animate a moment from the story. You'll pitch your idea to your classmates and, possibly, AME professionals.

# Developing the Project

You will complete tasks related to animation *pre-production* (the process of preparing to make the animation) and *production* (the process of making the animation).

## Step 1: Choose and describe your story.

Choose a short work of fiction that you think would make a good animated movie. The story could be a:

- fairy tale
- folktale
- myth
- short story
- narrative poem

For example, you might choose the story of Icarus, one of the Raven tales from the Native American tribes of the Pacific Northwest, or a short story you've read in English class. Try to choose a story that hasn't already been made into an animated movie.

If you do choose a story that's already been animated, you'll need to alter it in some way. For example, you can set the story in another culture or in a different time period. You could also change the characters in a way that makes your animation original and fresh. For example, you could change human characters in a fairy tale into animals.

Ask yourself:

- How does the story benefit from the medium of animation and the visual freedom that animation provides?
- Is the story fun, action-packed, or interesting for another reason (for example, does it have a strong message or moral)?
- What kind of audience would find the story engaging? Keep in mind that most animations are made for kids, although some also have crossover appeal to adults (which is good for the parents taking their kids to see it!).

- Does the story have a clear arc—a beginning, a conflict in the middle, and a resolution at the end? (Animations, like other story forms, usually follow this story arc.)
- Are there characters that audiences can connect with?
- Are there aspects of the story that would translate well into a visual format? For example, does the story take place in another world or are the characters fantastical or stylized?

Once you've chosen your story, describe it on **Handout 13: Story Description**.

## Step 2: Choose a scene from the story.

Your project is going to focus on one scene. Think about the following questions:

- What role does the scene play in the story? (For example, does something happen in the scene to develop a character's personality? Does the scene introduce the conflict in the story? Does it show the resolution of the conflict?)
- What is happening emotionally to the characters in this scene?
- What is happening with the plot?
- Is a conflict resolved or is a character changed in some way (or both)?
- Is there an obstacle the character needs to overcome?

## Step 3: Choose a moment from your scene to animate.

Because animation is time-consuming, you won't be able to animate the whole scene you've chosen. Instead, you'll animate just one moment of the scene. The moment should involve no more than two characters (and having just one character is ideal). It should not include any dialogue, as you won't be animating speaking characters during the unit.

The moment will be brief—only 10–12 seconds long. Remember that for each second of animation you need at least 12 frames. So, 10 seconds of animation means at least 120 drawings!

Your moment could center around something like the following:

- A conflict being resolved
- A character having an important emotional reaction
- A crucial action taking place
- A character having a change of heart or a change of mind
- Something interesting happening visually
- Something funny happening

As you choose your moment, answer the following questions:

- Would I enjoy animating this moment? (Remember, you'll spend a lot of time drawing it!)
- How challenging will it be to animate this moment?
- What does this moment tell viewers about the story?
- Will this moment be visually engaging for viewers?

## Step 4: Design and draw a character.

Design the main character. Before you begin, decide on the animation style you'll work in.

Choose a style that matches your story and the audience. For example, if you're telling a goofy story aimed at young kids, you might draw in a more cartoon-like style. A more serious story may require a more polished look. If you're telling a myth or folktale from a specific culture, you might draw the animation in the style of art from that culture.

Once you choose your style and design your character, you'll create several drawings:

- *A turnaround sheet:* One sheet of paper with drawings of a character from different views—for example, the front, back, and side views of a character. This can be a relatively loose drawing, as long as it shows accurate proportions.
- *Character studies showing expression:* A set of drawings that show the character expressing different emotions—happiness, sadness, surprise, and so on. Choose emotions that the character feels in your scene. Some drawings can be heads only, and others can be whole-body poses.



Character studies for Po from *Kung Fu Panda*.
Image courtesy of DreamWorks LLC.

- *A model sheet:* A polished, cleaned-up drawing of your character in a typical pose. The drawing should show the character's personality and how the character carries his or her body. Model sheets often include turnaround drawings. However, yours will just include the polished drawing of your character.
- *A simplified design for animation:* A drawing that reduces the character to some simple shapes and one or two defining features. When you create your animation, it would be very time-consuming to draw your polished character for each frame—so instead you'll create a simplified version of the character.

Simplified character design for Po from a *Kung Fu Panda* storyboard. Image courtesy DreamWorks LLC.

**Note:** If your character interacts with objects during the scene, you'll need to design those, too.

## Step 5: Storyboard your moment.

*Storyboards* are drawings of individual frames or shots from a scene in the production. You'll create a storyboard of the moment you are animating, and use the storyboard to help you plan and draw your final animation.

## Step 6: Animate the moment.

First, you'll draw the frames of your animation by hand. Your next step is to capture them digitally. You'll then use software to create the final animation.

You'll also use the software to ink in your drawings—tracing over the drawings digitally to create the final images for the animation. The term *ink in* comes from the early days of animation, when artists would trace over an animator's drawings using ink on celluloid or acetate (plastic sheets).

## Step 7: Pitch your story idea.

At the end of the unit, you'll pitch your animated movie idea to classmates and, possibly, to AME professionals as well. You'll describe the story, share your artwork and animation, and explain why your story would make a great animated movie.

## Assessment Checklist 3:
# Unit Project—Character Design

Use this checklist to help you plan and assess your project. Make sure that you include all the required components. Your teacher will use this checklist to help evaluate your work.

| Requirements | Percentage of Total Grade | Comments | |
|---|---|---|---|
| **Technical Knowledge and Skills** | | **Student Comments** | **Teacher Comments** |
| Turnaround sheet shows the character from the front, side, back, and three-quarter profile views, and character is drawn consistently in all four views. | **10%** | | |
| Model sheet depicts a detailed, polished rendering of the character in a typical pose. | **10%** | | |
| Simplified character design is appropriate for animation. | **10%** | | |
| Character design includes features that make the character easily identifiable. | **5%** | | |
| Character design includes features that lend themselves to follow-through and overlap. | **5%** | | |
| Students' drawing and animation techniques demonstrate skill, effort, and perseverance. | **10%** | | |

**Content**

| | | | |
|---|---|---|---|
| Character's appearance (e.g., clothing and facial features) reflects the character's personality and is appropriate for the story. | 10% | | |
| Style in which the character is drawn is appropriate for the story. | 10% | | |
| Character studies show several emotions, and the emotions expressed are appropriate for the character's personality and the student's chosen scene. | 10% | | |

**Creative Expression**

| | | | |
|---|---|---|---|
| Character design makes effective use of the elements of art and principles of design. | 10% | | |
| Character is visually interesting and incorporates features that will make it appealing when animated. | 10% | | |
| **Total** | **100%** | | |

# Handout 13:
# Story Description

Briefly describe the story you've chosen by answering the questions below.

| | |
|---|---|
| What is the title of your story (or the movie that will be based on the story)? | |
| What is the arc of the story? | |
| Who is (are) the main character(s)? | |
| What are the goals of the main character(s)? How is the character transformed (emotionally or physically) during the story? | |
| Describe the setting of the story. What kind of world does the story take place in? What does it look like? | |
| Why do you think this story would make a good animated movie? | |
| What style will you draw your animation in? Why is this style a good match for the story? | |

## Handout 14:
# About Review Groups

As you work on your unit project, you will meet with a small team of students to discuss your work in progress. This team is your review group. Your review group members will give you feedback on your work in progress, offer advice, and support you as you work—and you will do the same for them.

Your review group should provide a safe, supportive environment for giving and receiving feedback. Think about the best experiences you've had giving and receiving feedback with other students—how did the giver of feedback behave? How did the receiver of feedback behave? Below are some tips to keep in mind.

As a giver of feedback:

- **Be considerate of your fellow review group members.** Be as thoughtful in your responses as you would like others to be in responding to you.
- **Speak up.** Your team members are depending on you for feedback, so don't be afraid to give your opinion.
- **Focus your comments.** For some critique sessions, you will be given a series of questions to focus on (see *Questions for Critique*, below). Focus your feedback on responses to these questions or to questions that the team member has generated.
- **Give honest but constructive criticism.** It won't help your team members in the long run if you tell them that their piece is perfect when it still needs some work. Be honest about areas that could use improvement and provide specific suggestions for how the work should change.
- **Point to visual evidence.** If you are making an observation about a team member's work, point to specific visual evidence rather than just offering general criticism. For example, instead of saying, "Your timing is off," say, "The timing seems too even—the ball doesn't speed up at the bottom of the bounce."
- **Be positive.** Comment on strengths as well as areas needing improvement.

As a receiver of feedback:

- **Ask for specific help.** Tell team members what you're having difficulty with and what issues you'd like feedback on.
- **Ask for clarification.** If you don't understand a team member's comment, ask him or her to explain it further.
- **Be open to suggestions.** Listen to team members' suggestions with an open mind and try not to be defensive about the work.

# Questions for Critique

For some of the critiques in your review group, you'll have a set of questions to use to guide your feedback. For your reference, these questions are listed below.

## Scene and Moment Choice

- Does this scene seem like a good choice to focus on? Why or why not?
- How challenging will it be to animate the student's chosen moment?
- Will the animation be visually interesting to viewers?
- Does this moment seem like a good choice to focus on? Why or why not?

## Initial Character Designs

- What can you tell about the character's personality and story by looking at him or her?
- How does the character's visual style support and reflect the story?
- Is the character appealing? Why or why not?
- Does the character's clothing and posture reflect the character's personality?
- What aspects of the character's look are successful? How does the use of the elements of art and principles of design contribute to that success?
- What aspects of the character could use further development? How might the animator change or improve his or her use of the elements of art and principles of design? What other suggestions do you have for improvement?

## Model Sheets and Simplified Characters

- Does the model sheet clearly convey the character's personality?
- Will the character be appealing for an audience once it's animated?
- Does the character have attributes that make it easily identifiable?
- Does the character have features that lend themselves to follow-through and overlap when they are animated?
- Will the simplified version of the character be easy to animate?
- Can you see any potential challenges the animator may face when animating this character? If so, what changes might you make to avoid those challenges?

## Storyboards

- Is it clear what is happening during the moment? If not, how can the animator make it clearer?
- Does the action in the storyboard seem believable and interesting? If not, what can the animator change?
- Is the animator incorporating the principles of animation? If not, what should the animator change in order to do so?
- Do the drawings on the storyboard make effective use of the elements of art and principles of design? Point to visual evidence and, if necessary, provide suggestions for how the frames can be redrawn in order to do so.
- Do you see any potential challenges the animator may face when animating this character? If so, what changes might you suggest to avoid those challenges?

## Animated Moment Pencil Test

- Does the animation look believable? Does the animated character have appeal? If not, what changes can the animator make?
- How is the animator making effective use of the elements of art and principles of design to convey the mood of the scene and engage the viewer? How might the animator revise drawings to more effectively make use of the elements and principles?
- Is the animator using squash and stretch effectively? What about the other principles of animation, such as timing and anticipation? If not, what changes can the animator make?
- Does the character seem to have weight and to move in a way that makes sense?
- Has the animator incorporated a secondary action into the animation? If so, does it support the primary animation? Why or why not?
- Are there any other changes that you would suggest?

# Assessment Checklist 4:
# Unit Project—Review Group

Use this assessment to assess your performance and the performance of members of your review group.

| | Comments | |
|---|---|---|
| | **In my review group, I . . .** | **My review group team members . . .** |
| Act in a considerate and respectful manner | | |
| Speak up to offer critiques and advice | | |
| Focus the critique on specific questions | | |
| Point to visual evidence during critiques | | |
| Give honest, constructive criticism | | |
| Focus on the positives in the work as well as the areas in need of improvement | | |
| Ask for help on specific areas of the work | | |
| Ask for clarification when necessary | | |
| Listen to others' suggestions with an open mind | | |

## Activity 2A.2: Choosing a Scene and a Moment

**1. Have students discuss their scene and moment with a partner.**
Distribute **Handout 15: Scene and Moment Worksheet**. Tell students that they will work with a partner, preferably someone who is not in their review group.

In their pairs, as students answer the questions on Handout 15 aloud, their partners should take notes on the worksheet.

> **Teacher's Notes: Handout 15**
>
> Having students work with partners outside of their review groups allows them to get additional points of view about their choices for their scenes and moments.
>
> Be sure to talk with each student about the moment he or she is choosing to animate. Read each student's completed Handout 15 to make sure that they choose moments that are feasible to animate, have a scope that is appropriate for the project, and last no more than 10 to 12 seconds.

**2. Have review groups discuss students' scene and moment choices.**
Have students take the worksheet that their partners created and meet in their review groups to discuss their scene and moment, using the Critical Response Process. Have students focus on these questions from Handout 14:

- Does this scene seem like a good choice to focus on? Why or why not?
- How challenging will it be to animate the student's chosen moment?
- Will the animation be visually interesting to viewers?
- Does this moment seem like a good choice to focus on? Why or why not?

Give students a few minutes to reflect on the discussion and make changes to their scene and moment choices as necessary, making notes on Handout 15 as they do so.

## Handout 15:
# Scene and Moment Worksheet

**Partner's Name:** _____

**Partner's Story:** _____

## The Scene

Why did your partner choose this scene?

What action happens during the scene? How does this scene move the story forward?

Who are the characters in the scene? What are their goals? Are there obstacles to those goals? Do the characters change (emotionally or physically) during the scene? If so, how?

## The Moment

Why did your partner choose this moment? What does this moment tell viewers about the story?

What happens during the moment?

How long is it? (Hint: If you or your partner aren't sure, act it out.)

Who is the main character in the moment? Are there any objects the character interacts with that your partner will need to animate? (For example, if the character picks up and eats an apple, your partner will need to draw an apple as part of the animation.)

# Activity 2B: Developing the Character

Students begin work on their unit project by designing the character they will animate.

## Sequence

| | |
|---|---|
| **2B.1:**<br>***Initial Character Design*** | Students learn about two more principles of animation. They sketch out a character design, conducting research on the character's visual attributes. Students share their designs and revise them based on feedback. |
| **2B.2:**<br>***Creating Turnaround Sheets and Character Studies*** | Students develop turnaround sheets and character studies showing expression. |
| **2B.3:**<br>***Finalizing the Character Design*** | Students create polished model sheets showing their character in a typical pose. They also create simplified versions of their character to use in their animations. |

## Materials Needed

- **Handout 16: Principles of Animation #2**
- Short animated movie clip that demonstrates the animation principles of follow-through and overlapping action and appeal (see *Advance Preparation*)
- **Handout 17: Character Description Worksheet**
- Paper
- Erasers
- Optional: Computers with Internet access and printers
- Students' copies of Handout 14
- Sample turnaround sheets (see *Advance Preparation*)
- Sample character studies showing expression (see *Advance Preparation*)
- Optional: Mirrors
- Sample model sheets (see *Advance Preparation*)
- Optional: Clips of pencil tests showing simplified characters (see *Advance Preparation*)

## Advance Preparation

- Students should have experience developing and drawing characters before completing this activity. If students have not taken *D/M/A Foundations in Visual Arts, Unit 5: Creating Characters*, determine which activities from Unit 5 you will use to introduce students to the process of character development. You might have students complete the character analysis at the beginning of the unit (Activity 1A.1), introduce them more fully to how to create turnaround sheets (Activity 1B.3) and character studies (Activity 2B), and analyze the styles of different animation houses (Activity 2A.2).

- Before Activity 2B.1, select a short animated movie clip that demonstrates the animation principles of *follow-through and overlap* and *appeal* (see Handout 16 for more information about these principles). See *Media & Resources* for animated movie suggestions.

  ---

  **Note:** A sample analysis of the use of these principles in Disney's *Snow White* is provided in Activity 2B.1.

  ---

- In Activities 2B.2 and 2B.3, students look at samples of turnaround sheets, character studies, and model sheets. For Activity 2B.2, prepare a set of sample turnaround sheets and sample character studies. For Activity 2B.3, prepare a set of sample model sheets. See **Appendix E: Sample Character Designs** and *Media & Resources* for links to examples.

  ---

  **Note:** A sample analysis of a character study sheet for Po, a character from *Kung Fu Panda*, is provided in Activity 2B.2.

  ---

- For Activity 2B.3, if you plan to show students clips from pencil tests that use simplified versions of characters, select the clips you will use. See *Media & Resources* for suggestions.

RESOURCES

## 2B.1: Initial Character Design

**1. Analyze a movie clip.**

Distribute **Handout 16: Principles of Animation #2** and give students a few minutes to read it.

Play the animated movie clip you selected. Have students analyze how the animation uses the principles of *follow-through and overlapping action* and *appeal*, writing notes on Handout 16 as they watch.

Have a few students share their analyses with the class. Ask:

- How can you incorporate these two principles as you design your character for your animation?

    *Possible answers: Students can design characters with physical characteristics or clothing (such as tails, hair, big bellies, or hats) that lend themselves to overlap and follow-through when they are animated. Students can design characters that are well drawn, have clear designs, have personalities that come through in the character design, and are visually interesting—these are the kinds of characters that will be appealing when animated. (Remind students that appealing does not necessarily mean likable or cute, since villains should be appealing too.)*

---

**Teacher's Notes: Sample Analysis of Disney's *Snow White***

The following is a sample analysis of the scene in Disney's *Snow White* in which the seven dwarves sing the "Silly Song" and dance (52:15 to 57:00).

*Follow-Through and Overlapping Action:* There are many examples of overlapping action. For example, the dwarves' hats have a tendency to move at different rates from the rest of their bodies, so the movement overlaps with the movement of their heads and bodies. Follow-through is more challenging to pinpoint, simply because the characters in the clip are constantly in motion, but it can be observed—for example, when Snow White puts her hands over her ears and recoils (56:30), she follows through backward for several frames.

*Appeal:* The seven dwarves are great examples of characters with appeal. Each dwarf is compelling to look at, has a clear personality, has a visual design that matches the dwarf's personality, and moves and behaves in a way that corresponds to that personality. For example, Dopey's big ears and oversized clothing clearly correspond to his "dopey" personality, and his facial expressions and movements reinforce this impression. At the same time, his exaggerated movements and goofy expressions make him fun to watch.

---

**2. Have students describe and sketch their character.**

Give students **Handout 17: Character Description Worksheet**. Tell them to answer the questions on Part 1 of the worksheet to flesh out their ideas for the main character in the scene they've chosen.

> **Note:** Additional character-development activities include filling out personality quizzes from magazines or Web sites in the guise of the character, or creating a profile on a social networking site for the character.

Give students paper, pencils, and erasers. Have students use the questions on Part 2 of the worksheet as a guide as they sketch their character designs. Encourage students to sketch several preliminary designs for their character to see what works best. Students should experiment with line (hard or soft), shape (angular or rounded), and style.

> **Note:** If students plan to include another character in their animated moment, have them create a simple design for this character as well. This character doesn't need to be as polished as the main character (for example, students won't need to create a model sheet).

---

**Teacher's Notes: Technology Adaptation**

Even if you are having students create their animations using 2-D or 3-D software, they should first sketch their designs with pencil and paper. Once they have gotten feedback and revised their designs, they can capture their pencil drawings and create finalized versions in a program such as Adobe Photoshop or Illustrator®.

If students are creating stop-motion animations, have them determine whether they will use ready-made objects (such as stuffed dolls, action figures, or Lego characters) for their characters, or sculpt them out of clay or other materials used to make puppets. If students plan to make their own characters, you will need to teach them sculpting or puppet-making techniques or collaborate with a fine arts teacher who can teach them these techniques. Students should still create sketches before they sculpt or make their characters.

**3. Have students complete Journal 4.**
Have students conduct research related to their character's look online or in the library.

## Journal 4

Conduct research on a visual aspect of your character. For example, if your character is in a story from an earlier time period, research the clothing worn at that time. If your character is an animal, find out how that animal looks and moves. Print or copy images to use as a reference as you work on your character design, and then add these images to your journal.

**Note:** You can have students use their research to create inspiration boards. For more about inspiration boards, see Activity 1B.3 of *D/M/A Foundations in Visual Arts, Unit 4: Make Me a World*.

Have students apply what they've learned through their research to their character design by drawing new ideas or modifying their old ideas. Have students settle on an initial design for their character.

**4. Have review groups give and receive feedback on initial character designs.**
Have students meet in their review groups. Have team members look at and critique one another's work, using the Critical Response Process and focusing on the following questions from Handout 14:

- What can you tell about the character's personality and story by looking at him or her?
- How does the character's visual style support and reflect the story?
- Is the character appealing? Why or why not?
- Does the character's clothing and posture reflect the character's personality?
- What aspects of the character's look are successful? How does the use of the elements of art and principles of design contribute to that success?
- What aspects of the character could use further development? How might the animator change or improve his or her use of the elements of art and principles of design? What other suggestions do you have for improvement?

**5. Have students revise their character designs.**
Students should incorporate their review group's feedback into their character design.

# Handout 16:
# Principles of Animation #2

Below is a description of two more principles of animation: *follow-through and overlapping action* and *appeal*. These principles will be helpful for you to think about as you work on your character design.

Your teacher will play an animated movie clip. Take notes on the principles as you watch the clip.

## Follow-Through and Overlapping Action

Think about a dog turning around quickly to look at something. Do all of its body parts move at the same time or at the same rate? No—its head may turn around first, followed by its body, and its tail may still be whipping around after the rest of its body has settled down. Follow-through and overlapping action pertain to the fact that different body parts move at different rates and times.

*Follow-through* means that the body doesn't come to an abrupt stop at the end of a motion. Try turning your head to look at something. Does your head stop abruptly at the end of the turn? Or does it travel a little farther than where you intended to look, and then you have to turn back, slightly? This is what follow-through represents in animation—a part of the body continues to travel for a few frames at the end of the movement.

*Overlapping action* means that parts of the body move at different rates—a bobbing ponytail may move at a different rate than the head, for example—and that some parts lag behind when a character changes direction or moves. Incorporating this principle creates visual interest for the audience, because characters are rarely perfectly still—some part of them is almost always in motion.



Dr. Cockroach's antennae lend themselves to overlapping action.
Image courtesy of DreamWorks LLC.

*Notes:*

## Appeal

The principle of appeal doesn't just mean creating likable characters—even bad guys whom people don't like can have appeal.

Animated characters who are appealing draw the audience in. Appealing characters are well designed, have clearly developed personalities, and move and act in a way that makes sense and is truthful to who they are.



Three characters from *Monsters vs. Aliens* whose personalities are reflected in their appearance and expressions. Image courtesy of DreamWorks LLC.

Appealing characters are the ones that the audience wants to watch on screen—even if they're the villains! Tai Lung from *Kung Fu Panda*. Image courtesy of DreamWorks LLC.

*Notes:*

## Handout 17:
# Character Description Worksheet

### Part 1: Personality and Backstory

An important part of developing a believable character is thinking about the character's personality and backstory—where the character comes from, the character's goals and desires, the kind of world the character inhabits.

Answer the questions below to help create your character's backstory. Some of your answers will come from the story you're basing your animation on. You'll need to develop the answers for other questions yourself, as part of the process of fleshing out your ideas for the character.

- What role does your character play in the story?

- What is the world of the story like? What people or creatures live there?

- How old is your character?

- How would you describe your character's personality at the beginning of the story (e.g., happy-go-lucky, serious, anxious)?

- How has your character's personality changed by the end of the story?

- What are your character's goals?


- What obstacles might be in the way of your character reaching those goals?



## Part 2: Sketching the Character

Your character's physical appearance should be driven by the story and by your character's personality. For example, a happy-go-lucky character who makes people laugh will look different from a mean-spirited character who wants to take over the world.

Create sketches of your character's design, keeping the following questions in mind:

- How does the style you are using reflect and support the story?
- How does the character's appearance (including clothing or jewelry) reflect the character's personality or story?
- What does the world of the story look like? What about the character's appearance tells us that he or she is part of this world?
- What is your character's general facial expression (e.g., sad or happy, expressive or withdrawn)?
- How does your character move—quickly or slowly? Gracefully or clumsily?
- How can you make sure that your character has appeal?

As you sketch, be sure to think about how you are using the elements of art and principles of design in your drawings.

## 2B.2: Creating Turnaround Sheets and Character Studies

**1. Analyze turnaround sheets.**

Display the turnaround sheets that you selected, and remind students that turnaround sheets show the character from multiple angles. These sheets allow animators to see any design problems and to lay the groundwork for creating animations.

Have the class analyze one or more of the turnaround sheets by answering the following questions:

- What can you tell about the character's personality by looking at the design on the turnaround sheet?
- What is one feature of the character that would make it clearly identifiable in a scene with other characters (for example, ears that stick out, dangling jewelry, crazy hair)? If this character were a silhouette, how would it be identifiable?
- Think about what this character would look like when animated, remembering the principle of *follow-through and overlapping action*. What parts of the character might have overlap? For example, does the character have a ponytail that might move at a different rate from the rest of its body?
- How does the character's design make effective use of one of the elements of art and principles of design?

---

**Teacher's Notes: Sample Analysis of Po from *Kung Fu Panda***

The following is an analysis of a character study sheet for Po from *Kung Fu Panda* found on Handout 12 and in Appendix E. The principles discussed here should also apply to your analysis of a turnaround sheet (and the character studies of Po show him from multiple angles, as would be done on a turnaround sheet).

The character studies show that Po might be somewhat goofy, expressive (or even overly dramatic), and skeptical or anxious on occasion. It looks like he might move somewhat clumsily or heavily.

Po's clearly identifiable features include his big belly, his dramatic black and white markings, and his small ears. His belly might lend itself to the principle of overlapping action, as might the loose strips of fabric on his clothing.

The character's design makes effective use of the design principle of *contrast*—the contrasting values of the black and white areas of Po's fur are visually striking and draw the viewer's eye. There is also a contrast in texture in Po's design—while white areas like the belly

---

appear to be smooth in texture, the black areas are rough and spiky-looking along the edges.

You might mention to students that in the turnaround sheet, the designer shows Po in very exaggerated poses and expressions to help the animator see how Po retains his proportions and design in these extreme cases.

Tell students that animators try to create characters that are easily identifiable in a scene—the characters have features that make them stand out. In addition, creating features of a character (such as a ponytail or a big belly) that have overlap and follow-through creates more visual interest for the audience and makes the animation seem more realistic.

Display the sample turnaround sheets so students can use them as models as they work on their own turnaround sheets.

**2. Have students create turnaround sheets.**
Have students use their initial design as a guide as they create a turnaround sheet showing views of their character from the front, back, and side and at a three-quarter angle. Their characters should maintain the same proportions when shown from different angles. Tell students that they can draw in a relatively loose, rough style—they'll create more polished drawings of their character when they create their model sheet.

Remind students that they should be thinking about how they are using the elements of art and principles of design as they work.

**Teacher's Notes: Drawing Techniques**

See *D/M/A Foundations in Visual Arts, Unit 5: Creating Characters*, Activity 1B, for information about drawing techniques. One technique is to draw a front view of the character and then draw horizontal lines as guides for height and placement of features in the other views. Some of the turnaround sheets linked to in *Media & Resources* include these guides.

As they work, encourage students to think about designing a character with features that are easily identifiable and that could have overlap and follow-through when animated.

**Teacher's Notes: Technology Adaptation**

If you are having students use 2-D or 3-D software, they should still create turnaround sheets and character studies by hand. They can then use software to refine their drawings (e.g., ink in or color them).

If students are sculpting characters for stop-motion animations, they can draw turnaround sheets before they start to sculpt. If they are using ready-made figures, you might have them place the characters in different poses that represent actions or emotions and take still photographs to use as references when they create their animations.

**3. Show character studies.**

Show students the sample character studies showing expression that you selected. Remind students that animators use character studies as a way to visualize what characters will look like when expressing different emotions.

**4. Have students draw character studies showing expression.**

Have students focus on drawing their character showing the kinds of emotions that are most likely to emerge during the scene they have chosen.

> **Note:** You can bring in mirrors and encourage students to act out emotions. Students can use their own facial expressions to guide them as they create their drawings. Students can also use one another as models.

Remind students to keep their turnaround sheets and character studies in their portfolios.

## 2B.3: Finalizing the Character Design

**Note:** Journal 5 allows you to assess students' drawing skills and use of the elements of art and principles of design, thereby providing a good opportunity for formative assessment.

**1. Show students model sheets.**
Display the sample model sheets you selected and explain that model sheets are used to show a final, polished character design. They show the character's personality and depict it in a typical pose, showing how the character holds its body and carries itself.

**Note:** If the model sheets you show include both a polished character design and turnarounds, focus on the polished character design for this activity. However, if time allows, you can also have students create polished, cleaned-up turnarounds to include on their model sheets.

Display the sample model sheets so students can use them as a model as they work on their own model sheets.

**2. Have students draw model sheets.**
Have students use all their drawings and sketches to create a final, polished model sheet.

**3. Have students draw simplified versions of their character for animating.**
Explain that because animation requires many drawings for each second of footage, it's not practical to use their fully detailed characters in the animations for their unit project—it would take too much time. In animation studios, professional animators might only finish a few seconds of animation in a week of full-time work.

Tell students that they will create simplified versions of their characters for their animation. These drawings should:

- consist of simple shapes that make up the outline of the character
- include defining characteristics that make it easy for the audience to identify the character (such as a big chin, ears that stick out, a skinny tail, or a tiara)
- maintain the same proportions as the fleshed-out character—it should be clear from looking at both the model sheet and the simplified version that they are the same character

**Note:** Optionally, you can show students clips of pencil tests that use simplified versions of characters. Point out how the characters are clearly identifiable but are still drawn more simply than fully detailed characters.

Have students draw their simplified characters.

**4. Have review groups share feedback.**

Have students meet in their review groups to share their model sheets and simplified characters. Have the review groups critique the work and offer feedback, using Critical Response Process and focusing on the following questions from Handout 14:

- Does the model sheet clearly convey the character's personality?
- Will the character be appealing for an audience once it's animated?
- Does the character have attributes that make it easily identifiable?
- Does the character have features that lend themselves to follow-through and overlap when they are animated?
- Will the simplified version of the character be easy to animate?
- Can you see any potential challenges the animator may face when animating this character? If so, what changes might you make to avoid those challenges?

**Note:** This activity offers a good opportunity for AME professionals to give feedback on students' work.

Remind students to keep their model sheets and their simplified character designs in their portfolios.

Tell students to fill in the Student Comments section of Assessment Checklist 3, either in class or outside of class. Let students know when you expect them to hand in this assessment.

**5. Have students complete Journal 5 in class or as a homework assignment.**

## Journal 5

If there is an important object that your character interacts with during the scene you've chosen, you'll need to design that object.

Create a design for the object, drawing it from all angles, as you did with your character. (If there's no object in the scene, you can design another object that's important in the story, even if it is not in your scene.) Make sure that the object is drawn in the same style as your character.

# Activity 2C: All About Walk Cycles

Students learn about creating walk cycles, a challenging and important task for animators. They watch a clip from an animated movie in order to analyze how the characters move as they walk. Students create a walk cycle animation for a simple figure and for their own character.

**Note:** This activity provides a good opportunity for formative assessment.

## Materials Needed

- Animated clip(s) with examples of walk cycles (see *Advance Preparation*)
- **Handout 18: Animating a Walk Cycle**
- Tools for drawing animation frames, for example:
    - Erasers
    - Peg bars and punched animation paper or thin sheets of paper clipped or stapled together at the top and taped to students' desks
    - Optional: Light tables

**Note:** Each student will need 34 sheets of paper for the walk cycles, plus additional paper for sketches and timing charts.

- Digital cameras or scanners
- Software for creating pencil tests
- Copies of **Assessment Checklist 4: Unit Project—Review Group**

## Advance Preparation

- Obtain a copy of the animated movie *Robin Hood* or another movie that contains examples of walk cycles for several different kinds of characters (e.g., heavy and light, tall and short, male and female). Select the clip you will show students. (The opening sequence in *Robin Hood* provides good examples of walk cycles.) You can also select clips from two different movies to compare walk cycles.

**1. Have students analyze the walks in an animated movie clip.**
Play the clip you selected. Have students pay close attention to the movements that characters make as they walk, keeping in mind the animation principle of *follow-through and overlapping action*. Play the clip at least twice, giving students time to take notes.

> **Note:** If you are having students watch the opening sequence of *Robin Hood*, the parade of characters showing the different walks begins about two minutes into the movie and lasts about 45 seconds. (The walks are followed by a series of runs, which are outside the scope of this activity.)

**2. Discuss the walk cycles in the clip.**
Tell students that the type of sequence they just watched is referred to by animators as a walk cycle—a series of frames representing the range of movements that a character makes when he or she walks. Walk cycles can often be looped to reduce the amount of drawing that animators need to do.

Ask students:

- What are the similarities in the movements the characters make as they walk?

  *Possible answers: The characters' heads move up and down as they go through the motion of walking; the arms (or limbs) move in the opposite direction of the legs, for balance; as body weight shifts to the weight-bearing leg, the hips dip toward the opposite side; all or most of the characters have features (hats, floppy ears, large stomachs, tails) that lend themselves to overlap and follow-through.*

- What are the differences in the movements the characters make as they walk?

  *Possible answers: The characters hold their bodies differently—some have an upright posture as they walk, while others lean over; the movements of the legs are different—some characters waddle, while others glide, march, hop, or strut; the distance the characters' feet cover varies depending on the length of their legs; the movements of the arms or limbs are different—some move stiffly back and forth, while others are fluid, and others barely move at all; the overlap and follow-through take place at different rates depending on the features of the character (for example, an elephant's big belly moves differently from the floppy hair of a dog).*

- What can you tell about a particular character's mood and body type by the way the character walks?

  *Possible answers: Answers will vary depending on the characters students are analyzing, but walks can reveal a lot about a character's mood—a stiff upright position might indicate officiousness or nervousness; someone who struts is probably feeling confident; someone who moves slowly might be sleepy; someone who hops or skips along might be playful or young. A character with a larger body may move more slowly than a character with a smaller body.*

**3. Have students create frames for a walk cycle and create a pencil test.**
Explain to students that creating walk cycles can be challenging, but it is an essential skill for animators to learn. Students may need to use a walk cycle in their own animations for their unit project.

Give students **Handout 18: Animating a Walk Cycle** and the tools to draw their animation frames. Have students use Steps 1–9 on the handout to draw a walk cycle for a simple figure.

> **Teacher's Notes: Observing and Drawing Walk Cycles**
>
> You can also have students observe one another walking to see the positions of the body and how the positions are similar to the key poses described on Handout 18.

As students work, teach them the techniques they need to know in order to create their walk cycles.

> **Teacher's Notes: Technology Adaptation**
>
> If students are using 2-D or 3-D software to create their animations, have them create a walk cycle for a stick figure or for a simple body shape. For 3-D software, there are often pre-made rigs and characters available online that you can download and have students use. You can also have them create a walk cycle for their own character.
>
> If students are creating stop-motion animations, have them create an animation of a walk cycle for their character(s) to use in their animation.

Have students create a pencil test (Step 10 on Handout 18). Have them create and play an animated loop of their walk cycle.

**4. Have review groups critique students' walk cycles.**
Have team members watch and critique one another's walk cycles, answering the questions from Handout 18. Give students blank copies of **Assessment Checklist 4: Unit Project—Review Group**. Have students assess their own and their team members' work.

**5. Have students create a walk cycle for their character.**
Have students follow Steps 11–15 on Handout 18 to create a walk cycle and a pencil test of the walk cycle for the simplified version of their character, incorporating the feedback they received in their review groups.

**6. Critique students' walk cycles.**
Have several students show their characters' walk cycles to the class. Have students watch and critique the work, using the questions on Handout 18 as they did earlier.

**7. Have students experiment with animations, using 12 distinct frames per second.**
Have students follow Step 16 on Handout 18 to create a pencil test with only 12 distinct frames per second (the equivalent of "shooting on twos" in traditional animation). Help students use the pencil test software to create the effect of shooting on twos by making sure the software is set to 24 fps, importing their images, and then creating duplicate frames of each image (holding each image for two frames).

Have students share their observations about differences between the two walk cycle pencil tests with the class. Students should note that although each walk cycle takes the same amount of time, the walk shot on twos (with only 12 frames per second) will not look as smooth. You can talk about the advantages of planning for 12 different frames per second (less time-consuming) vs. the drawbacks (less smooth).

## Handout 18:
# Animating a Walk Cycle

A *walk cycle* is a series of frames that depict a character's movement as it walks. Creating walk cycles is a common, yet challenging, task in animation.

A full walk cycle shows the character taking two steps—one with the right foot and one with the left foot. Once a walk cycle is created, it can be looped, or played over and over again, so that the character appears to take as many steps as is required.

Follow the numbered steps below to draw a walk cycle for a simple figure. This walk cycle is a generic cycle. If you were creating a walk cycle for a heavy or a light character or to show a character's personality, you would change the motion and timing, but the principles remain the same.

### Step 1: Draw a simple figure.

Before you start to work on your walk cycle, you need a figure that you can make walk! Draw a simple human figure made of basic shapes—don't include any facial features, hair, or clothing. The simpler the better! However, you shouldn't draw a stick figure either—you'll be able to apply what you're learning to your own character more easily if the figure has some volume. (See the picture below for an example.)

### Step 2: Draw guidelines for the figure's walk path.

Lightly draw horizontal guidelines at the bottom of a page and at the height that will be at the top of the figure's head when both feet are contacting the ground. (See the drawing below for an example.) These lines will be a guide you can use for your character's walk. If the paper you are using is thin enough, you can place the guide underneath each sheet as you work. Alternately, you can copy the guidelines, or just the bottom guideline, on each sheet.

### Step 3: Sketch the key, extreme, and breakdown poses.

There are four important poses in a walk cycle: contact, recoil, passing, and high-point. These poses are shown below:



Contact     Recoil     Passing     High-Point     Contact     Recoil     Passing     High-Point
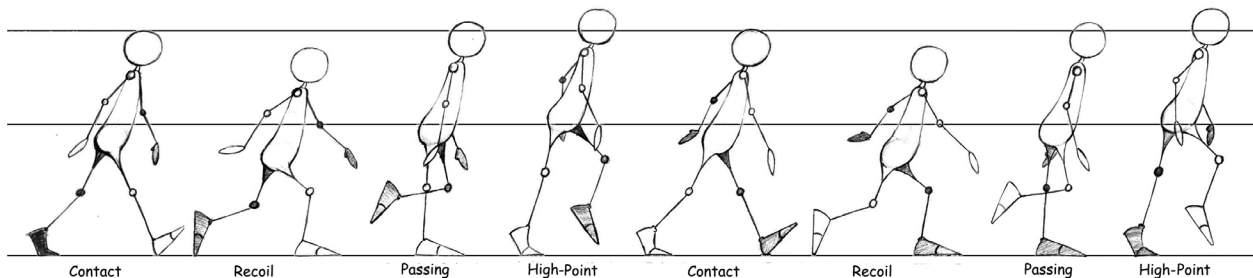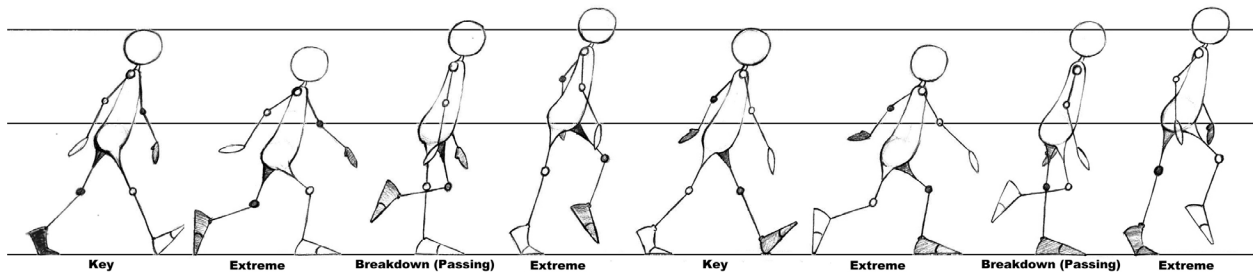
Drawing by Brock Ramirez

- The *contact* pose shows the heel of the front foot hitting the ground, with the arm on the same side of the body swung in the opposite direction from the foot. (In the drawings above, the left arm and left leg are shaded to distinguish them from the right arm and right leg.)
- The *recoil* position shows the foot flat on the ground with the knee bent, while the opposite leg (back leg) starts to lift off. Notice that the head and the rest of the body are at their lowest point in this position.
- The *passing* position shows the leg with the foot on the ground straightening out, the arms in toward the body, and the opposite leg lifting and bending. The head has come back up, slightly above where it started.
- The *high-point* position shows the foot on the ground lifting off, while the opposite leg begins to come down. The head is at its highest point in this position of the walk cycle.
- Next, the opposite leg comes down, and the body is again in a contact pose. This time the legs and arms are reversed from the original position.

Notice that the figure in each drawing is leaning forward slightly. When we walk, our bodies aren't straight up and down—they lean.

In the walk cycle:

- The *contact poses* are the key poses.
- The *recoil* and *high-point poses* are extreme poses.
- The *passing pose* is a breakdown pose.



Drawing by Brock Ramirez

Sketch your figure in these four poses as a rough guide for your drawings.

> **Tip:** To help you keep track of which leg and arm is which, shade in the left leg and arm. (Animators often shade the leg and arm farthest from the viewer to make them visually distinct from the other leg and arm.)

## Step 4: Create a timing chart.

Create a timing chart with the nine poses listed below (for a walk cycle starting on the right foot):

- Contact pose, right foot
- Recoil pose, right foot
- Passing pose, right foot
- High-point pose, right foot
- Contact pose, left foot
- Recoil pose, left foot
- Passing pose, left foot
- High-point pose, left foot
- Contact pose, right foot

You will create an inbetween pose between each of these poses, for a total of 17 poses on your chart. These 17 poses should be evenly spaced.

This is a complete walk cycle. Once you animate it, you can play the cycle in a loop to have the figure walk continuously.
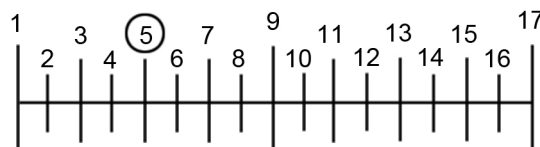
## Step 5: Draw the first key (contact) pose.
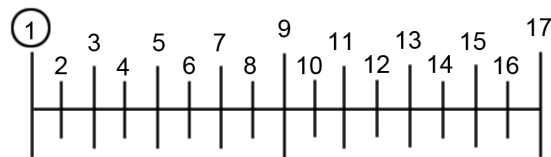


Number each corner of your sheets of paper from 1 to 17. Put a circle around the numbered pages that will have the three key poses: 1, 9, and 17.

Start with page 1 and draw your figure in the first key pose (the contact pose), using the sketches you made in Step 2 as a guide.

## Step 6: Draw the first breakdown (passing) pose.



Next, you're going to draw the first breakdown pose—the passing pose in the middle of the contact poses. You'll draw this pose on page 5.

Be sure to position the passing pose on the paper so that the heel of the figure's right foot is in the same place as the heel of the right foot in the contact pose. If you stack your drawings, the right heel should be in the same place on each sheet of paper—just as if the figure were walking, as shown below:
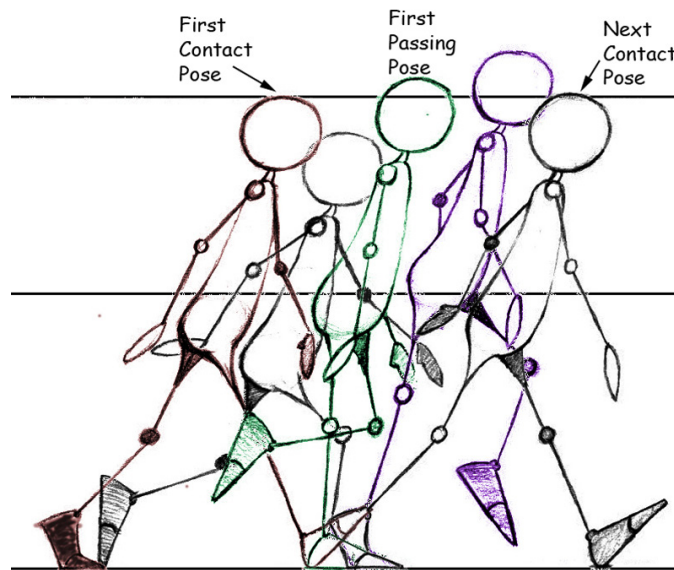


Drawing by Brock Ramirez

Draw the breakdown pose on page 5, using the sketches you made in Step 2 as a guide. Draw the figure so that the heel of the contact foot (the right foot) is in the same place on the ground as it was in the drawing on page 1.

**Note:** You can take your paper off the pegs (or out of the clips) and use your first drawing (page 1) as a guide to make sure that the volume and proportion of your figure are consistent from pose to pose.

## Step 7: Draw the remaining key and breakdown poses.
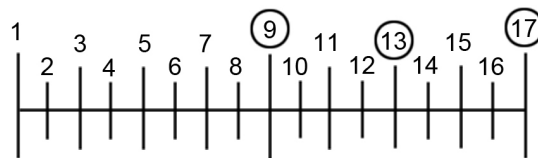


Draw the remaining contact poses and passing pose in the following order:

- Key pose (contact pose) (page 9)
- Breakdown pose (passing pose) (page 13)
- Key pose (contact pose) (page 17)

---

**Note:** The final key pose (page 17) should look exactly the same as the first key pose (page 1). You can use page 1 as a guide to trace it.

---

As you draw, move the figure forward on the page as it shifts from the right foot to the left foot.

---

**Note:** The poses for the right and the left foot are almost exactly the same—the only difference is which leg or arm is forward.

---

As you work, flip or roll your drawings to check your progress and make corrections.

## Step 8: Draw the extreme poses.
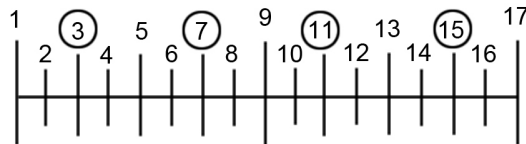


You should have five poses drawn (pages 1, 5, 9, 13, and 17). Now go back and draw the extreme poses between the poses you've already drawn. These are the recoil poses and high-point poses. Draw them in the following order:

- Recoil pose (page 3)
- High-point pose (page 7)
- Recoil pose (page 11)
- High-point pose (page 15)

Roll or flip your drawings to check your progress and make corrections.

## Step 9: Draw the inbetween poses.
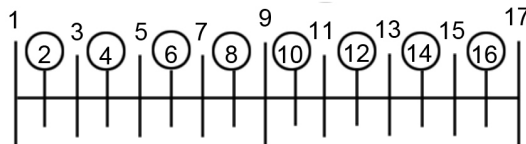


Look at your key poses on pages 1 and 3 and then draw the figure on page 2 in a position that's between those two poses. Flip or roll your drawings to make sure that the inbetween drawing looks right.

Follow the same process to create the rest of your inbetween poses on pages 4, 6, 8, 10, 12, 14, and 16.

## Step 10: Create a pencil test.

Capture your images and use software to create a pencil test of your animation. Create a loop of the animation and play it back.

As you look at your animation, answer the following questions:

- Does the animation look smooth?
- Is the walk believable?
- Are there any parts of the walk cycle that don't look right? (For example, does the figure seem to be limping, or is its head bobbing up and down too much?)
- Do you feel the character's weight as it takes a step, or does it seem to be "floating"?
- What changes can you make to address any problems or issues you noticed?

## Step 11: Sketch poses for a walk cycle for your own character.

Now think about a walk cycle for your own character. Sketch the four important poses in a walk cycle (contact, recoil, passing, high-point) for the simplified version of your character. If you identified any changes you would have liked to make to your first walk cycle, be sure to incorporate those.

## Step 12: Draw the key poses and breakdown poses.

Number each corner of your pages from 1 to 17 and circle the key poses.
Draw the contact poses and passing poses for your character's walk cycle, following the same process as you did in Steps 5–7. Roll or flip your drawings as you work.

## Step 13: Draw the extreme poses.

Now go back and draw the recoil and high-point poses for your character, following the same process as you did in Step 8.

## Step 14: Draw the inbetween poses.

Finally, draw the inbetween poses for your character, following the same process as you did in Step 9. Roll or flip your drawings as you work.

## Step 15: Create a pencil test.

Capture your images and use software to create a pencil test of your character's walk cycle. Create a loop of the animation and play it back.

As you look at your animation, answer the same questions as before:

- Does the animation look smooth?
- Is the walk believable?
- Are there any parts of the walk cycle that don't look right?
- Do you feel the character's weight as it takes a step, or does it seem to be "floating"?

- If you were to do this activity again, what changes would you make to address any problems or issues you noticed?

## Step 16: Experiment with animating only 12 different frames per second.

So far, you've mostly animated 24 distinct frames per second (sometimes fewer, if you included holds in your animation). However, as you know, the illusion of motion can be created in as few as 12 frames per second. Traditional animators often used this fact to their advantage when working under tight deadlines and budgets (for example, when creating animations for TV) by using a process called "shooting on twos." If an animation was shot on twos, each drawing was played twice in a row—the same process as using holds, but applied to every image in the animation. This way, only 12 distinct images were drawn for every second of animation (as opposed to "shooting on ones," when 24 distinct frames are played for every second of animation).

When you create your final animation, you may, to save time, shoot on twos for at least part of the animation—drawing only 12 distinct frames for every second of animation. To see what effect this will have on your animation, create a pencil test of a walk cycle that is shot on twos:

- Make a pencil test using only the key, extreme, and breakdown poses (frames 1, 3, 5, 7, 9, 11, 13, 15, and 17).
- To create the effect of shooting on twos, insert a duplicate frame of each image (as you did when you experimented with holds) and play the animation at 24 fps.

Observe the differences between the new walk cycle shot on twos and the original walk cycle shot on ones. What do you see?

# Part 3: Creating the Animation

Students animate a moment from a scene in their story. To prepare, they create a storyboard of the moment. They draw the frames for their animation, capture their drawings with a camera or scanner, and ink in and animate the drawings using 2-D software.

Students incorporate the principles of animation as they work, trying to effectively use the elements of art and principles of design. Throughout the process of creating their animations, students revise their work based on feedback.

**Length**
**20 50-minute sessions**

## Activity 3A: Creating Storyboards

Students create a storyboard for a moment in their chosen scene.

### Sequence

| | |
|---|---|
| **3A.1:** **More Principles of Animation** | To learn about the remaining principles of animation, the class analyzes a clip from an animated movie. |
| **3A.2:** **Storyboarding the Moment** | Students create a detailed storyboard of the moment in their story that they plan to animate. |

### Materials Needed

- **Handout 19: Principles of Animation #3**
- Clip from an animated movie (see *Advance Preparation*)
- Sample storyboards (see *Advance Preparation*)
- **Handout 20: Making Storyboards**
- **Assessment Checklist 5: Unit Project—Moment Storyboard**
- Paper for storyboarding (several sheets per student)
- Students' copies of Handouts 3 and 16
- Students' copies of Handout 14

## Advance Preparation

- Before beginning Part 3, students should be familiar with the visual conventions of movies (such as types of shots, angles, and camera movements). If they have not taken *D/M/A Foundations in Media and Digital Design: Unit 2: Telling Stories with Moving Images*, give them **Handout 3: The Language of Cinematography** from that unit. You can also have students analyze a clip from a movie (live-action or animated) as described in Activity 1B: Tools of the Visual Storyteller (also from Unit 2). Before Activity 3A.1, select a short animated movie clip that demonstrates the animation principles of *anticipation*, *staging*, *secondary action*, and *exaggeration* (see **Handout 19: Principles of Animation #3** for more information). See *Media & Resources* for animated movie suggestions.

  **Note:** A sample analysis of the use of these principles in Disney's *Fantasia* is provided in Activity 3A.1.

- Before Activity 3A.2, gather several sample storyboards—ideally, including some from animated movies—to show the class. See *Media & Resources* for suggestions.
- For Activity 3A.2, students should be familiar with the process of creating storyboards. If students do not have prior experience with storyboards, you can have them complete storyboarding activities from *D/M/A Foundations in Visual Arts, Unit 3: Community Stories*, such as storyboarding a scene from an existing movie (Activity 3A.1).

## 3A.1: More Principles of Animation

**1. Have pairs analyze a movie clip.**
Give students **Handout 19: Principles of Animation #3**. Explain that the handout describes the remaining five principles of animation.

Play the animated movie clip you selected and have students analyze how the animation uses the principles of *anticipation*, *staging*, *secondary action*, and *exaggeration*, writing notes on Handout 19 as they watch.

Have volunteers share their observations with the class.

  **Note:** Students will not analyze the use of solid drawing, because it can be challenging to pick out and point to in a finished animation. However, you can discuss the principle with students and remind them that solid drawing skills are one of the foundations of successful animations.

### Teacher's Notes: Analyzing the Movie Clip

The following are examples of visual evidence that students might point to for each principle.

- *Anticipation:* A character might draw back his arms and a leg in preparation to run; a character might look offscreen, causing viewers to anticipate that a new person or object will soon enter the frame; a character might look in the direction of an object before picking it up.

- *Staging:* An important emotional moment might be shown in a close-up shot, in order to show a character's face; a "spooky" scene might be filled with black cats, leafless trees, shadows, or clouds passing across the moon; to focus on an action, the movement in the rest of the scene might be kept to a minimum.

- *Secondary action:* A character who is crying (primary action) might wipe away a tear (secondary action); an angry character might cross her arms (secondary action) as she walks across a room (primary action); a nearsighted character might put on his glasses (secondary action) as he peers down to look at something on the floor (primary action).

- *Exaggeration:* A character's eyes might appear to pop out of his head when he gets angry; a character's legs might appear to move so fast when she is running that they turn into a blur; an action may be made (or an emotion may be expressed) more broadly than it would in real life.

### Teacher's Notes: Sample Analysis of an Animation

The following is a sample analysis of "The Sorcerer's Apprentice," one of many vignettes in Walt Disney's *Fantasia*:

- *Anticipation:* When Mickey is sneaking around to get the sorcerer's hat, he has an excited expression as he looks offscreen at something (31:17 and 31:19), which then turns out to be the hat. He also stretches out his arms to reach for the hat before he picks it up. Both of these actions help the viewer anticipate the action of Mickey picking up the hat. When Mickey first brings the broom to life (31:50), the broom crouches down a little bit before hopping forward, preparing for the movement of hopping in the way that a person might, and helping the audience to anticipate the hop.

- *Staging:* The beginning of the clip (29:50) uses dramatic staging— almost all of the frame is black, and the only light emanates from the cauldron, illuminating the sorcerer. The cauldron and the

sorcerer are placed near the middle of the frame, reinforcing the sorcerer as the focus of the viewer's attention. The viewer also looks up at the sorcerer from below, making the sorcerer seem more powerful. The overall effect is that the scene has a spooky or ominous feeling, and the viewer understands that the sorcerer is a powerful figure. This effect is reinforced by the use of ominous music.

- *Secondary Action:* There are several examples of secondary action throughout. One clear example is that as Mickey empties a bucket of water, he peers over his shoulder to look at the sorcerer (30:46). Another is at 31:33, when Mickey fixes the oversized robe flopping over his arm.

- *Exaggeration:* Mickey's movements are somewhat exaggerated as he carries the water buckets, reinforcing their heaviness. Mickey's movements and facial expressions are exaggerated when he wipes his brow after setting down the buckets (30:07). When Mickey tiptoes into the room (31:10), his exaggerated movements emphasize the fact that he's trying to be quiet; when he turns around and moves at the bottom of the stairs, his legs run in a circle for a few frames before he actually moves.

Once students have shared their analyses, ask:

- How can you make use of these principles as your create your animation of a moment from your story?

  ***Possible answers:*** *Students might mention:*

  - *Making sure that the audience anticipates the action through visual cues*
  - *Staging their moments carefully (i.e., focusing on the placement of the character in the frame and how much of the character appears in the frame)*
  - *Including their characters' secondary actions in addition to the main action*
  - *Exaggerating one aspect (such as action or an emotion) while being careful not to over-exaggerate*

  ---

  **Note:** At this point in the unit, you may want to remind students of the other principles of animation that they have learned, for example, by having students analyze the clip for the use of those principles as well.

  ---

**2. Have students analyze the use of the elements of art and principles of design.** Play the movie clip again and have students analyze the use of the elements of art and principles of design. Have students share their observations with the class.

## Handout 19:
# Principles of Animation #3

As you work on your unit project, think about how to incorporate the remaining principles of animation, as well as the other principles you've learned, to make your animation believable and engaging.

Your teacher will play an animated movie clip and assign you and a partner one of the principles below. Take notes on how the principle is used as you watch the clip.

## Anticipation

Think about baseball pitchers when they are getting ready to throw the ball. Do they throw the ball from a regular standing position? No—pitchers first wind up and pull their throwing arm back. They do this in order to prepare physically for the throw, but this movement also creates *anticipation*—it prepares the spectators (and the batter) for what's coming next.



Po looks at the dumplings as his arm reaches forward, creating anticipation for the audience that he will try to pick one up and eat it. Image courtesy of DreamWorks LLC.

Animators create anticipation to prepare the audience for an action that is about to occur. For example, a character might crouch down slightly to prepare for a jump or look in the direction of an object before picking it up.

*Notes:*

# Staging

Think about a crowded street scene in a movie. How do you know what is important on the screen? How do you know where to look or what the emotional tone of the scene is?



Dramatic staging in Po's dream sequence, *Kung Fu Panda*.
Image courtesy of DreamWorks LLC.

In animation, just as in the movies and in plays, *staging* directs the audience's attention and keeps the focus on what's important in the story.

Staging in an animation can include many elements, for example:

- Lighting
- The placement of characters and objects in the frame
- The angle and position of the scene within the frame
- The use of line, color, and texture

For effective staging, these elements must work together to tell the audience what's important, what the mood of the scene is, and what action or character is the central focus of the scene.

*Notes:*

## Secondary Action

*Secondary actions* are moves that a character makes in addition to the character's primary action. They add interest to a scene and provide more information about the character or story. For example, as a character walks down a street (primary action), you can tell that she is bored because she sighs (secondary action) or puts her hands in her pockets (secondary action). If she is happy, she may whistle or snap her fingers.

Secondary action should enhance the main idea of the scene and support the primary action. It should not take the focus away from the primary action. Secondary actions reveal a character's uniqueness, how the character feels, and what the character thinks.

*Notes:*

## Exaggeration

*Exaggeration* is a technique that makes a scene, character, or action more pronounced or extreme than it would be in real life. Exaggeration can help make a point about a character or event and often makes the scene more interesting and lively.

Animators exaggerate facial expressions (for example, making a character's eyes seem to pop out of its head), movements, objects, or backgrounds. However, animators need to be careful not to take exaggeration too far or a scene might look cartoon-like or distorted.

*Notes:*

## Solid Drawing

*Solid drawing* refers to the principles and skills that fine artists use to make the objects in a 2-D drawing look like objects in the real, 3-D world. These principles and skills include good composition, use of perspective, and an understanding of both anatomy and the principles of physics. (In this usage, *solid* means "high quality" or "technically skilled.")

For animators, *solid drawing* also means understanding how to maintain proper mass and volume of shapes and characters when they move, squash, and stretch. Solid drawing helps to create a believable world for the audience, one in which characters and objects move and act in realistic ways. Even though some computer-generated animation does not involve much "drawing," the same principles of solid drawing apply.

## 3A.2: Storyboarding the Moment

**Teacher's Notes: Additional Storyboarding Activities**

If you'd like your students to get more experience creating storyboards, you can have them create storyboards of their entire chosen scene instead of just a single moment.

These storyboards should include a new drawing for each new "shot"—that is, for each time the viewer's perspective on the action changes. (In storyboarding for a live-action movie, this would be every time the camera moved—for example, cutting from one character's face to another.)

If a lot of action occurs within the same shot, students can include multiple drawings for that shot. Each frame of the storyboard should also include written information, such as dialogue or instructions for camera movement.

If time permits and the technology is available, students can use their storyboards to create *story reels* (also called *animatics*)—animated storyboards that may also include dialogue or other sounds. Story reels can be created with video editing software, such as Apple Final Cut or Adobe Premiere®. Students can also add music or sound effects to their story reels.

**1. Discuss storyboarding with students.**

Show students the animation storyboards you selected and remind them that storyboards are used in the pre-production stages of media products, such as movies and TV shows. Ask:

- Why do you think storyboarding is an important part of the process of creating animations?

    *Possible answers: Storyboarding lets animators lay out and visualize each scene so they can see what works and what they might need to change before they actually begin animating. This saves time and work later on. Change becomes more difficult and costly once the animation process has begun.*

    *Storyboarding is particularly important for animation because the storyboard drawings can be used as a reference or starting point for the animation drawings. The storyboards represent a roughed-out version of the final product.*

Give students **Handout 20: Making Storyboards** and **Assessment Checklist 5: Unit Project—Moment Storyboard**. Have students read the information on the handout and checklist. Answer any questions they may have about the storyboarding process.

> **Note:** You can post the sample storyboards around the classroom for reference as students work on their own storyboards. You can also show students the animated clip from *Kung Fu Panda* that corresponds to the storyboard drawings shown in Handout 20 (56:23).

**2. Have students storyboard their moments.**
Give students paper and tell them to draw storyboards, focusing on drawing the simplified version of their character, any objects that the character interacts with, and any secondary characters that are needed. Remind students that they should create enough storyboard frames to clearly show all the action.

> **Teacher's Notes: The Storyboarding Process**
>
> Students' storyboards are in essence a rough draft of their animations. Storyboards give students an opportunity to try out their visual ideas and to test the length of (and therefore the number of drawings needed for) their chosen moment.
>
> Encourage students to refer to Handouts 3, 16, and 19 to remind themselves of the principles of animation that can help them bring their moment to life.
>
> Remind students that they should also think about how to effectively use the elements of art and principles of design in their storyboard drawings.

**3. Have review groups critique storyboards.**

> **Note:** As teams meet, look at students' storyboards to make sure that it is feasible for students to create the animations they are planning.

Have students use the Critical Response Process, focusing on the following questions from Handout 14:
- Is it clear what is happening during the moment? If not, how can the animator make it clearer?
- Does the action in the storyboard seem believable and interesting? If not, what can the animator change?
- Has the animator incorporated the principles of animation? If not, what should the animator change in order to do so?
- Do the drawings on the storyboard make effective use of the elements

of art and principles of design? Point to visual evidence and, if necessary, provide suggestions for how the frames can be redrawn in order to do so.

- Do you see any potential challenges the animator may face when animating this character? If so, what changes might you suggest to avoid those challenges?

---

**Note:** Rather than revising their storyboards based on feedback received during this session, students will incorporate the feedback into their drawings for the animation in Activity 3B.

---

Remind students to keep their moment storyboards in their portfolios.

Tell students to fill out the Student Comments section of Assessment Checklist 5, either in class or outside of class. Let students know when you expect them to hand in this assessment.

**4. Optional: Assign students an animation exercise from Appendix A.**
If time permits, assign students one of the drawing exercises from **Appendix A** to complete in class or as a homework assignment.

## Handout 20:
# Making Storyboards

*Storyboards*, which are used in the pre-production phase of movies, TV shows, and other media products, are drawings of individual frames or shots from a scene in the production. When you look at these drawings sequentially, you can preview how the action plays out, the setting where the action takes place, and the kinds of shots (such as close-up or wide) that will be used.

Storyboards are frequently used in animation because it's important to know exactly what a scene looks like before work begins on the final animation. Unlike live-action movies, in which it's possible to choose from different takes or to re-shoot scenes, animation is so time-consuming and expensive that each scene must be finalized before production begins. In fact, storyboarding in the form it is used today was developed at the Walt Disney animation studio in the 1930s!

You will create a storyboard of the moment you've chosen to animate.

## Tips for Drawing Your Storyboard

- Create as many drawings as necessary to convey all the important action that takes place in the moment. For example, you may need only one drawing to show a character watching another character walk away, but you may need several drawings to show the acrobatic action of a character jumping over an obstacle.
- For each frame, include a drawing and set aside a space where you can write information, for example:
  - Camera directions (e.g., "Camera pans to follow Mary as she walks" or "Camera close-up on Mary's face")
  - A short description of what's happening in the shot (e.g., "Billy stands in a park with his dog Spot," "Billy gets ready to throw the ball," "Billy tosses the ball into the air.")
  - Note that because you are creating a storyboard for a very short interval of time, you may not need written information for each frame.
- The drawings shouldn't be *too* polished or *too* detailed—at this point, you're still just planning for the animation, not creating the animation itself!
- Refer to your simplified character design and other character drawings as you draw. Although your drawings will be rough, they should still be "on model"—that is, following the character's established design.
- Think about staging and shot style—when do you want a close-up of a character's face? When do you want a wide shot that shows more of the action?
- Think about the moment from your character's point of view. Where has she come from and where is she going? What state of mind is she in? What is her motivation? How do these factors affect how she looks and acts in this moment?
- The storyboard should show how your animation will incorporate the principles of animation (for example, using good staging or showing how a character's shapes will squash and stretch in different frames).

## Sample Storyboard

The storyboard below from *Kung Fu Panda* is one example of how a storyboard can be used to visualize a moment from a movie. Note the use of simplified character designs, especially for Po the panda.



Images courtesy of DreamWorks LLC

## Storyboard Model

You can use the model below as a guide to creating your storyboard. Decide on the size of each frame—you may want to have several frames on a page or one page per frame. Note that the frames in this model are in a widescreen format (used for movies and for high-definition television) rather than a 3:4 format (used in classic television).

Name: Page:
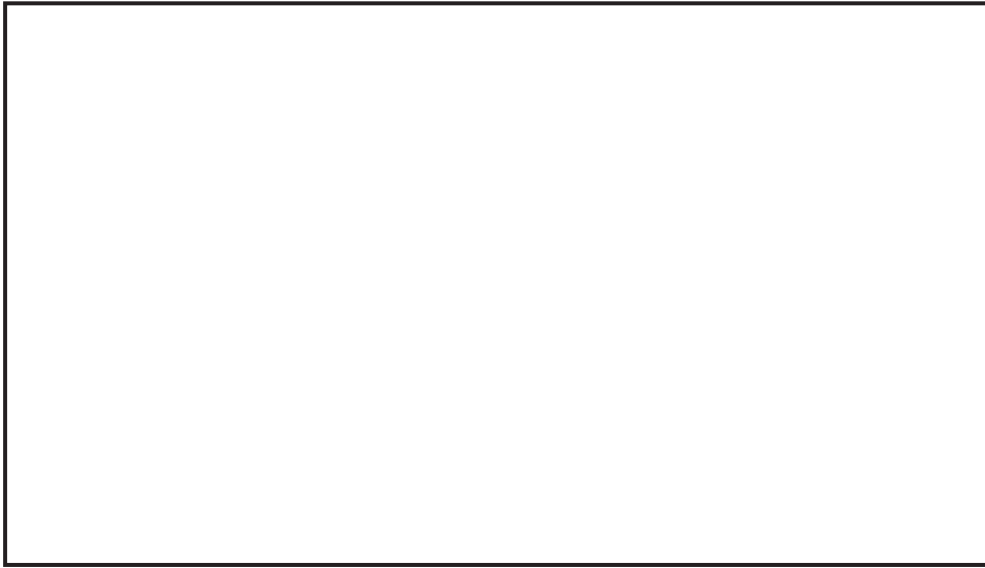
### Assessment Checklist 5:
# Unit Project—Moment Storyboard

Use this checklist to help you plan and assess your project. Make sure that you include all the required components. Your teacher will use this checklist to help evaluate your work.

| Requirements | Percentage of Total Grade | Comments | |
|---|---|---|---|
| **Technical Knowledge and Skills** | | **Student Comments** | **Teacher Comments** |
| Drawings clearly convey the action that takes place during the moment the student plans to animate. | **15%** | | |
| Drawings show how the student plans to incorporate the principles of animation (by, for example, showing squash and stretch). | **15%** | | |
| Storyboard includes written information, such as explanations of the action and camera directions, as necessary. | **10%** | | |
| Character drawings reflect the established character design. | **10%** | | |
| **Content** | | | |
| Character's poses and emotions are appropriate for the character's personality and physical features. | **10%** | | |
| Action taking place in the moment clearly reflects the story the student has chosen. | **10%** | | |

| Creative Expression | | Student Comments | Teacher Comments |
|---|---|---|---|
| Drawings make effective use of the elements of art and principles of design. | 10% | | |
| Drawings reflect student's understanding of how to use shot styles and staging effectively to tell a story. | 10% | | |
| Action depicted in the storyboard will be engaging for viewers. | 10% | | |
| Total | 100% | | |

# Activity 3B: Drawing the Moment

Students draw the key frames of their animation, create a pencil test to help them determine the timing of the animation, and get feedback on their pencil tests. Students then draw their animations and create a second pencil test.

> **Teacher's Notes: Managing Activities as Students Animate**
>
> Depending on how much equipment (cameras or scanners and computers) is available in your classroom, it may not be feasible for all students to work on the sequential steps in this activity at the same time.
>
> Instead, you can encourage students to move at their own pace, thus staggering the image capture and pencil test processes. Review groups can meet to discuss one team member's work and reconvene when another team member is ready.
>
> You can also assign students work from **Appendix A: Additional Animation Exercises** or have them work on their weekly critique assignment as they wait their turn to use equipment.

## Materials Needed

- **Assessment Checklist 6: Unit Project—Completed Animation**
- Optional: Students' copies of **Handout 7: Bouncing Ball Pose-to-Pose Animation**
- Optional: Stopwatches
- Students' storyboards of their chosen moment
- Students' simplified character designs
- Erasers
- Peg bars and punched animation paper or thin paper clipped or stapled together at the top and taped to students' desks
- Optional: Light tables
- Digital cameras or scanners
- Computers
- Software for creating pencil tests

**1. Have students create preliminary timing charts for their animations.**
Give students **Assessment Checklist 6: Unit Project—Completed Animation** and answer any questions they have about how their unit project will be assessed.

Have students create preliminary timing charts for their animations. If students need a reminder of how to use timing charts, have them refer to **Handout 7: Bouncing Ball Pose-to-Pose Animation**. As they create their charts, students may find it useful to act out the moment and time themselves with a stopwatch.

> **Note:** Students may want to break up their timing chart so they have different charts for each action the character completes during the animation. Students can also make timing charts for individual movements (such as the movement of an arm or a head) as needed.

Remind students that they should plan to create at least 12 different frames per second.

---

**Teacher's Notes:**
**Deciding on the Number of Distinct Frames Needed per Second**

There may be some circumstances when a motion is so fast that it will look jerky when only 12 different frames per second are used; in this case, students should draw additional inbetweens so that each frame is different (the equivalent of "shooting on ones").

Below are some examples of a timeline showing one second of animation. The timeline is split into 24 frames, since animation is shot at 24 fps. Each circle indicates a unique drawing.

Here is one example of how a student might time out the key poses. Since there are only four key poses in this second, the student can hold on certain drawings for longer or shorter lengths of time, depending on what creates the clearest motion. The motion will look jerky, popping from one pose to the next, but the audience will mentally fill in the blanks if the keys are spaced correctly.
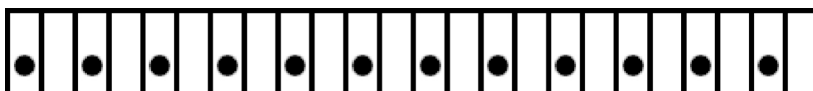
Here, the student has completed the extreme poses, breakdowns, and inbetweens to fill up this second of animation. This timeline represents "shooting on twos," since each unique drawing is held for two frames, creating a clear illusion of movement.
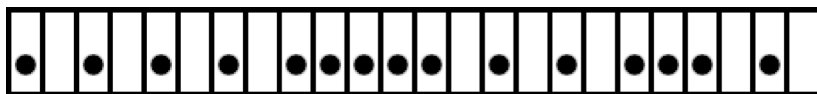
Here, the student has drawn additional inbetweens in the areas that felt jerky when playing back the animation. These areas where the drawings are held for only one frame represent what's known in animation as "shooting on ones." Additional inbetweens can be added anywhere that they're needed—they may only be necessary in very complex movements.

**2. Have students draw key and extreme poses.**

> **Note:** Encourage students to modify this process to meet their needs. This process assumes that students use pose-to-pose animation—students may also use straight-ahead animation, or a combination of the two techniques.

Have students refer to their storyboards, their simplified character designs, and the feedback received from their review groups as they draw first their key and then their extreme poses.

Remind students to keep in mind the principles of animation and to think how best to use the elements of art and principles of design to convey their ideas. As they work, students should roll or flip their drawings to check their work.

**Teacher's Notes: Additional Animation Techniques**

As students work, you may want to discuss these additional animation techniques.

*The Moving Pause*
When a character or action comes to a stop, the character should still remain "alive" and continue moving, although in a very subtle way. Students should understand that their moment may have a point of "stillness" in it and that they can use the same principles of animation at a point of stillness that they use at points where obvious actions occur.

*Getting Inside the Mind of the Character*
Animators often think not only about what happens during the action, but also what happens between actions. For example: *What is the character thinking as he reaches for an apple? How does the character feel about the alarm going off?* How would you as an animator react to something versus the character that you're animating?

If students are having difficulty with a movement or are not sure how to create a pose, encourage them to get into the mind of the character and imagine what it would be like to be in that scene. This thinking process can help their animation become more than just a series of actions—it can become a story that the viewer cares about.

**Teacher's Notes: Technology Adaptation**

If students are creating their entire animations using computers, have them begin to draw their animations using 2-D or 3-D software. Be sure to teach them any additional techniques they need to know. You can have them create frame-to-frame animations or animations that use key poses and tweening.

If students are creating stop-motion animations, have them set up their scenes and begin to take photos. As they work, have them use stop-motion animation software to test their animations.

**3. Have students create pencil tests.**

Have students use digital cameras or scanners to capture their drawings and create pencil tests. Since only the keys and extreme poses have been drawn, students should hold these poses for as many frames as necessary in order for the motion to look correct. Encourage them to use their timing charts as a guide.

**Note:** Students' pencil tests provide a good opportunity for formative assessment.

**4. Have review groups critique pencil tests.**

Have students meet in their review groups, play their pencil tests, and give and receive feedback on one another's tests using the Critical Response Process. Have students focus on the following questions:

- Does the animation look believable? Does the animated character have appeal? If not, what changes can the animator make?
- How is the animator making effective use of the elements of art and principles of design to convey the mood of the scene and engage the viewer? How might the animator revise the drawings to more effectively make use of these elements and principles?
- Is the animator using squash and stretch effectively? What about the other principles of animation, such as timing and anticipation? If not, what changes can the animator make?
- Does the character seem to have weight and to move in a way that makes sense?

- Has the animator incorporated a secondary action into the animation? If so, does it support the primary animation? Why or why not?
- Are there any other changes that you would suggest?

**5. Have students revise their key and extreme poses, and revise their timing charts.**
Tell students to incorporate their review group's feedback as they revise their key and extreme poses and/or draw new poses. Remind them to roll or flip their work as they revise.

Students should also revise their timing charts based on what they observed looking at their pencil tests and the feedback they received.

**6. Have students draw their breakdown and inbetween poses.**
Have students draw the remaining frames of their animations by doing the following:

- Drawing any breakdown poses between the extreme and the key poses, or between two key poses.
- Draw inbetween poses as necessary to create the appropriate timing.

Students should roll or flip their drawings as they work.

**7. Have students create a new pencil test.**
As students complete their drawings, have them photograph or scan them and create pencil tests.

> **Note:** Because students will need to photograph or scan a large number of drawings, you may want to have them work on the capture process in batches—drawing two or three seconds of animation, scanning the drawings, then working on more drawings.

**8. Have the class critique pencil tests.**
Encourage students to address the following questions as they give their feedback:

- How engaging and believable is the moment? How might the animator change the spacing, timing, or poses to improve it?
- How smooth is the animation?
- How does the animation make use of the principles of animation?
- What is successful about the animation?
- What changes could the animator make to improve the animation?

> **Note:** This activity offers a good opportunity for AME professionals to give feedback on students' work.

**9. Have students make final changes to their drawings.**

Have students incorporate feedback into their drawings, photograph or scan any revised or new drawings as necessary, and run their pencil test with the updated drawings to make sure that they are satisfied with their animation.

> **Note:** Be sure to look at and approve students' final pencil tests before students go on to create their digital animations.

**10. Optional: Have students draw or paint backgrounds for their animations.**

If time permits, have students draw, paint, or digitally create a background for their animation. Students can use the background as part of their pitch at the end of the unit.

If you have time to teach students the appropriate technical skills, you can have students insert their backgrounds into their digital animations.

## Assessment Checklist 6:
# Unit Project—Completed Animation

Use this checklist to help you plan and assess your project. Make sure that you include all the required components. Your teacher will use this checklist to help evaluate your work.

| Animation | Percentage of Total Grade | Comments | |
|---|---|---|---|
| **Technical Knowledge and Skills** | | **Student Comments** | **Teacher Comments** |
| Clearly depicts the action that takes place during the moment. | **10%** | | |
| Makes effective and appropriate use of the principles of animation. | **10%** | | |
| Uses the student's simplified character design, and the character stays "on model" (follows the established design). | **5%** | | |
| Drawings maintain appropriate volume and shape. | **5%** | | |
| Makes effective use of timing and spacing to create smooth and believable motion. | **5%** | | |
| Demonstrates technical proficiency in using animation software. | **5%** | | |
| Students' drawing and animation techniques demonstrate skill, effort, and perseverance. | **5%** | | |

**Content**

| | | | |
|---|---|---|---|
| Character moves and expresses itself in a way that makes sense, given its personality. | 10% | | |
| Animation's drawing style reflects and supports the story. | 10% | | |
| Action taking place in the moment clearly reflects the story the student has chosen. | 5% | | |

**Creative Expression**

| | | | |
|---|---|---|---|
| Makes effective use of the elements of art and principles of design. | 10% | | |
| Is engaging and enjoyable for viewers. | 10% | | |
| Reflects student's understanding of how to use shot styles and staging effectively to tell a story. | 5% | | |
| Includes a character with appeal. | 5% | | |
| **Total** | **100%** | | |

# Activity 3C: Creating Digital Animations

Students work with their drawings in 2-D animation software. They ink in their pencil drawings and make adjustments to the animation based on feedback they receive. Students may also color in their drawings.

## Materials Needed

- Computers (1 for each student)
- Software for creating 2-D computer-generated animation
- Students' digitally captured drawings for their animated moments (created for their pencil tests in Activity 3B)
- Copies of **Assessment Checklist 4: Unit Project—Review Group**

**1. Show students how to use 2-D software to ink in and animate their drawings.**
Explain to students that they will now *ink in* their drawings—trace over their drawings digitally to create the final images for their animations.

> **Note:** Students might want to "clean up" (refine and polish) their drawings before the inking phase, depending on how rough their drawings are. If this is the case, they will need to re-scan or re-shoot any cleaned-up drawings.

Show students the techniques needed to digitally ink in and animate their drawings, for example:

- Importing their images into the software
- Creating layers and turning them on and off
- Using drawing tools to trace over drawings
- Altering and erasing lines made by drawing tools
- Playing the animation

### Teacher's Notes: Inking In Without Using Tablets

If your class is using Flash, you can have students do line art (and thus ink in the drawings) with a mouse. The program can simulate a pressure line based on the curve of the mouse movement. Other programs may have similar functionality.

Most programs also have a tool that allows users to trace a path with a series of points and then manipulate that path (e.g., the pen tool in Flash).

If students are having difficulty inking in their drawings, you might have them perform a substitute task using the software. For example, students can add features (such as ears or clothes) that they did not include in their initial drawings.

**2. Have students ink in their drawings.**
Remind students to periodically play back their work to see how their animation is progressing and whether they need to make changes (such as adjusting the line thickness).

**3. Optional: Have students color their drawings.**
If time permits, you can have students color their drawings. Show students the techniques they need to do this, such as using paint or fill tools.

**4. Have review groups look over completed digital animations.**
Be sure that teams understand that at this point feedback should focus on suggestions for polishing the animation or for changing the animation if the animator were to create it again.

Give students blank copies of **Assessment Checklist 4: Unit Project—Review Group**. Have students assess their own and their team members' work.

**5. Have students export their animations.**
Show students how to export their animation to the appropriate format (the format they will use during their pitch in Part 4).

Remind students to keep a copy of their animations in their portfolios.

Tell students to fill out the Student Comments section of Assessment Checklist 6, either in class or outside of class. Let students know when you expect them to hand in this assessment.

# Part 4: Pitching the Work

Students prepare and deliver pitches for their animated movie idea to an audience of classmates and, ideally, AME professionals. Students reflect on their work in the unit.
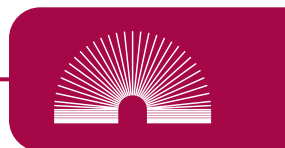
**Length**
**3 50-minute sessions**

## Advance Preparation

- If you have invited AME professionals to attend the pitch session in Activity 4B, confirm the arrangements with them.

## Activity 4A: Preparing for the Pitch

Students develop their presentations for the pitch session.

## Materials Needed

- **Handout 21: The Pitch**
- **Assessment Checklist 7: Unit Project—Pitch**
- Optional: Students' completed copies of Handouts 13, 15, and 17
- Students' portfolios, including their turnaround sheets, character studies, model sheet, storyboard of a moment, and final animation

**1. Discuss the pitch process with students.**
Distribute **Handout 21: The Pitch** and **Assessment Checklist 7: Unit Project—Pitch**. Give students a few minutes to read over the handout and assessment. Answer any questions students may have about the pitch process.

Tell students how long (in minutes) their pitches should be.

**2. Have students prepare their pitches.**
Have students use Handout 21 to guide them as they prepare to pitch their animated movie idea. Students can refer to Handouts 13, 15, and 17 as they work.

**3. Have students complete Journal 6 in class or as a homework assignment.**
Encourage students to look at the work in their portfolios as they write and reflect.

## Journal 6

Reflect on your work during this unit by writing about the following questions:

- What did you learn about the process of adapting a story for animation?
- What's the most important thing you learned about creating successful animations?
- What did you find most surprising about the animation process?
- What was your favorite part of the unit project to work on, and why?
- What would you do differently if you were to do this project again?

## Handout 21:
# The Pitch

You've found your story, designed your character, and created your animation—now it's time to share your idea! You will design and deliver a pitch for your animated movie concept.

Design your pitch to convince your classmates—and others in the audience—that the story you've chosen would make great use of the medium of animation. Your animated moment should be a good preview of what your movie might look like.

Look over the information below to see what to include in your presentation.

## Story Description

Briefly describe your story, answering the following questions:

- What is the basic plot of the story?
- Who are the main characters?
- Why do you think the story would make a good animated movie?
- What audience would the movie appeal to?

## Character Information

Present your character design, including turnaround sheets, character studies, and model sheet, answering the following questions:

- What role does this character play in the story?
- What is the character's personality?
- Why will this character be appealing for an audience to watch?
- Why is your character designed in the animation style that you've chosen?

## Scene and Moment Description

Show your storyboard of the moment and describe the scene and moment you've chosen, answering the following questions:
- What happens in the scene you've chosen, and why did you choose this scene?
- What role does this scene play in the story's arc?
- How does the moment you've chosen fit into the scene?
- What happens during this moment, and why did you decide to animate it?

## Screening of the Animated Moment

Play the animation you created and answer any questions the audience has.

## Assessment Checklist 7:
# Unit Project—Pitch

Use this checklist to help you plan and assess your project. Make sure that you include all the required components. Your teacher will use this checklist to help evaluate your work.

| Requirements | Percentage of Total Grade | Comments | |
|---|---|---|---|
| **Pitch** | | **Student Comments** | **Teacher Comments** |
| Clearly describes the story. | 15% | | |
| Convincingly explains why the story would make a good animated movie. | 15% | | |
| Clearly describes the character and the character's role. | 10% | | |
| Clearly describes the scene and the role it plays in the story's arc. | 15% | | |
| Clearly describes the moment and how it fits into the scene. | 15% | | |
| Effectively uses visual materials to support the presentation. | 20% | | |
| Successfully addresses the audience's questions. | 10% | | |
| Total | 100% | | |

# Activity 4B: Pitch Session

Students pitch their animated movie ideas to the class and reflect on what they learned during the unit.

## Materials Needed

- Students' copies of Assessment Checklist 7

**1. Have students deliver their pitches.**
Have students pitch their animated movie ideas and screen their animations for the audience. Give the audience time to ask questions at the end of each pitch.

> **Note:** If you plan to have AME professionals attend the pitch session, you may want to meet with them in advance to discuss how to deliver honest and constructive feedback to students in a positive manner so that students do not become discouraged.

**2. Discuss reflections on the unit.**
Conduct a group reflection on the unit using the questions students answered for Journal 6.

Tell students to fill out the Student Comments section of Assessment Checklist 7, either in class or outside of class. Let students know when you expect them to hand in this assessment.

# Appendix A:
# Additional Animation Exercises

Use these animation exercises to give students additional practice and to help them better understand the principles of animation.

## Additional Ideas for Animating a Ball

- Animate a ball that has an extra feature, such as a tail or a cape. This helps students learn how to use the principle of *follow-through and overlap*.
- Animate a ball that has more character than an ordinary bouncing ball. For example, show the ball doing the following:
  - Getting ready to "jump" off a surface, pausing for a moment before springing up to show anticipation
  - Jumping and then "splatting" on the ground instead of bouncing
  - Jumping and then landing as if it were a rock
  - Bouncing once and then scurrying off the page
  - Bouncing and then shattering
  - Bouncing and then flying

## Ideas for Animating a Flour Sack

Animating a flour sack is a classic animation exercise.

- Because a flour sack doesn't have limbs or a face to use for expression, this exercise illustrates the importance of posing and good acting to convey thoughts and emotions. Have students animate a flour sack clearly expressing an emotion, such as anger, joy, frustration, or sadness.
- To learn more about showing weight and creating appropriate movement, have students animate the flour sack as it completes an action—for example, falling off a shelf and gradually settling to the ground. Another option is to have students make the flour sack walk or dance. Encourage students to think about how to show their flour sack's personality in this exercise as well.

## Additional Walk Cycle Exercise

Have students animate a figure that walks onto the page from outside the "frame," walks to the center of the sheet, and then walks in place. If this is done well, in the pencil test it will look as though the camera is following the figure, rather than that the figure is walking in place.

## "Take Animation" Exercise

- Have students animate a character that starts out feeling happy or content and then reacts to something surprising or scary.

- Have students create a "double take," in which the character starts out happy or content, looks at something blankly for a moment, goes back to a contented state for a split second, then quickly looks again and reacts. This exercise uses many principles of animation, such as timing, spacing, squash and stretch, overlap, and exaggeration.
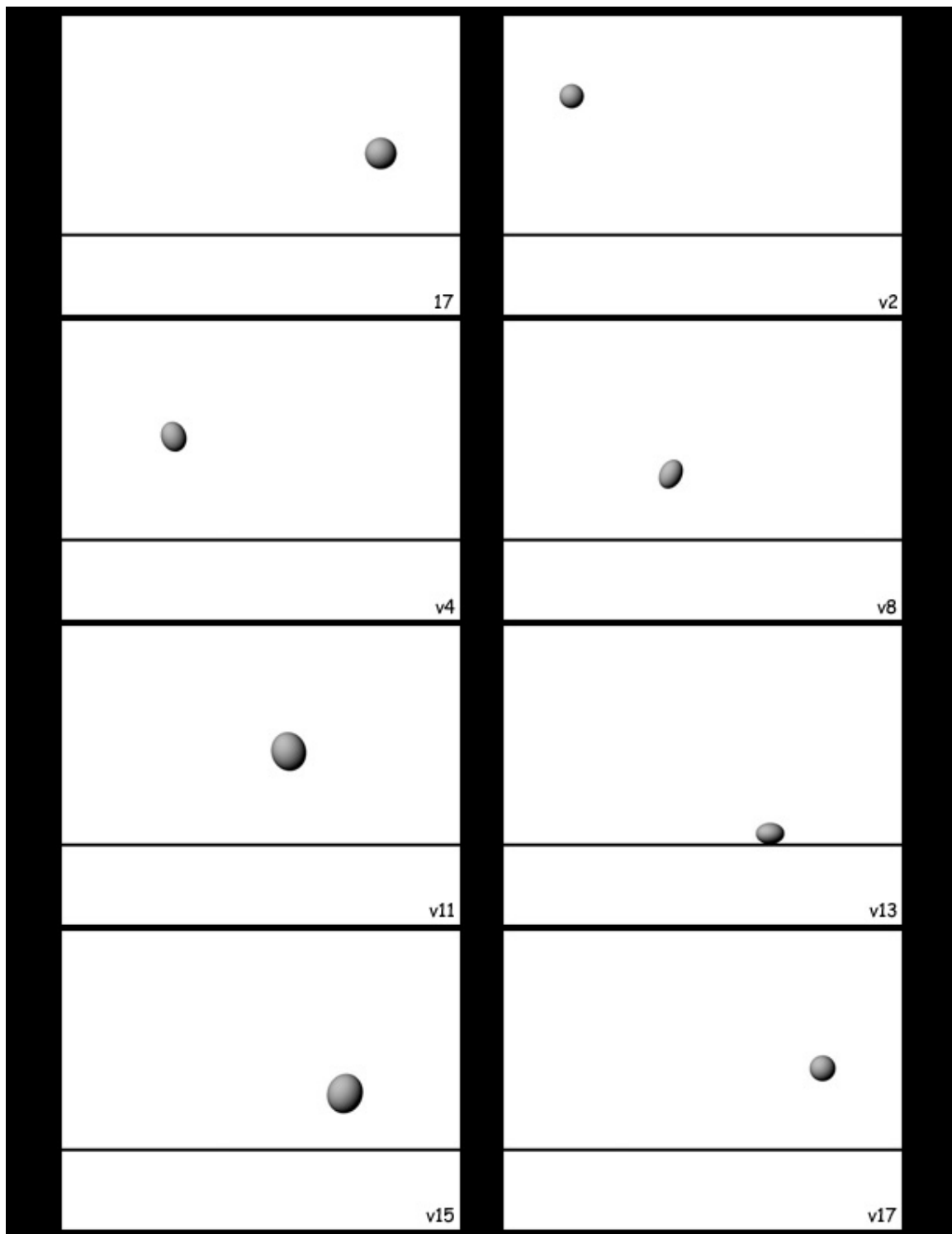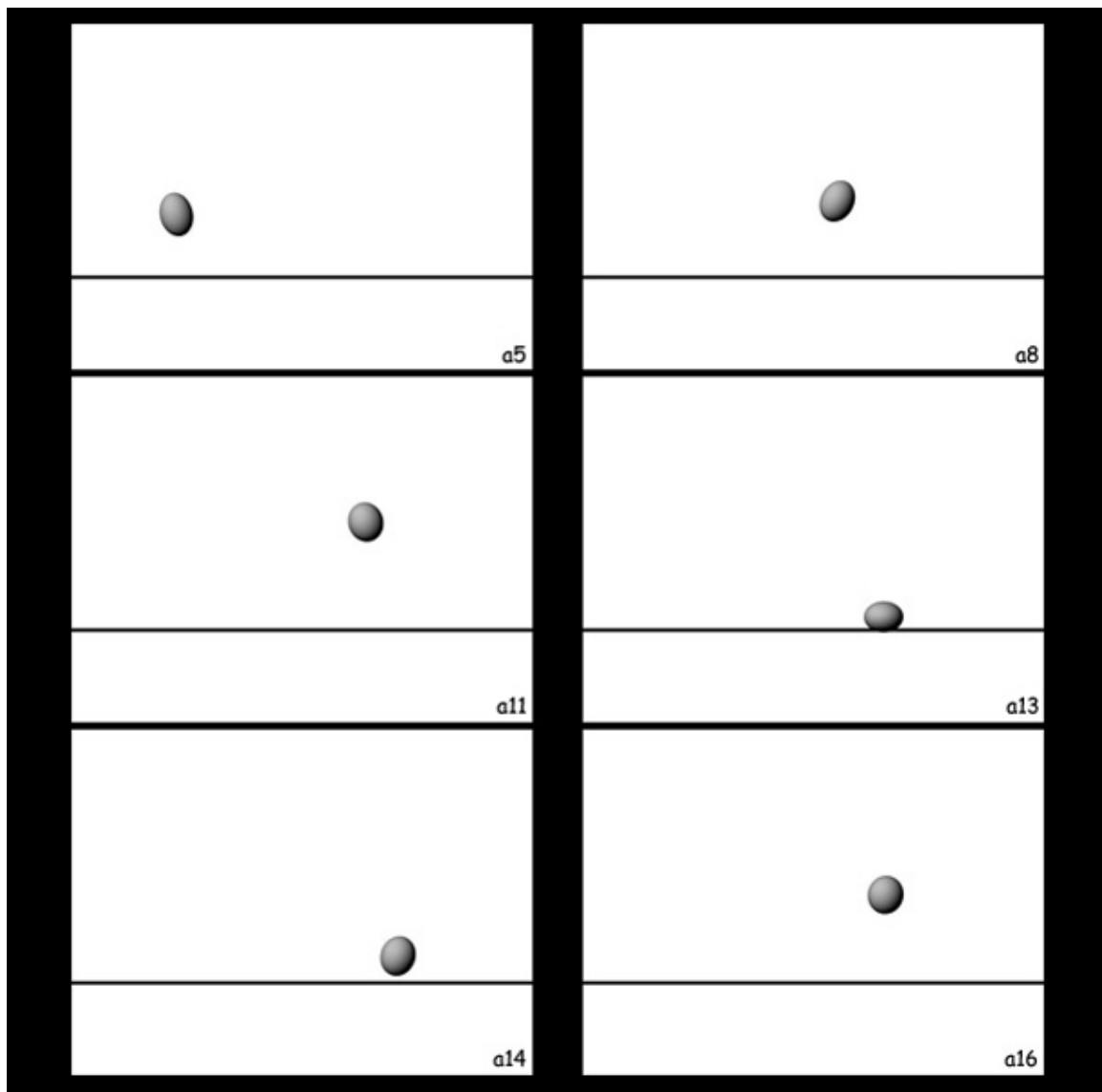
# Appendix B: Flipbook Pages
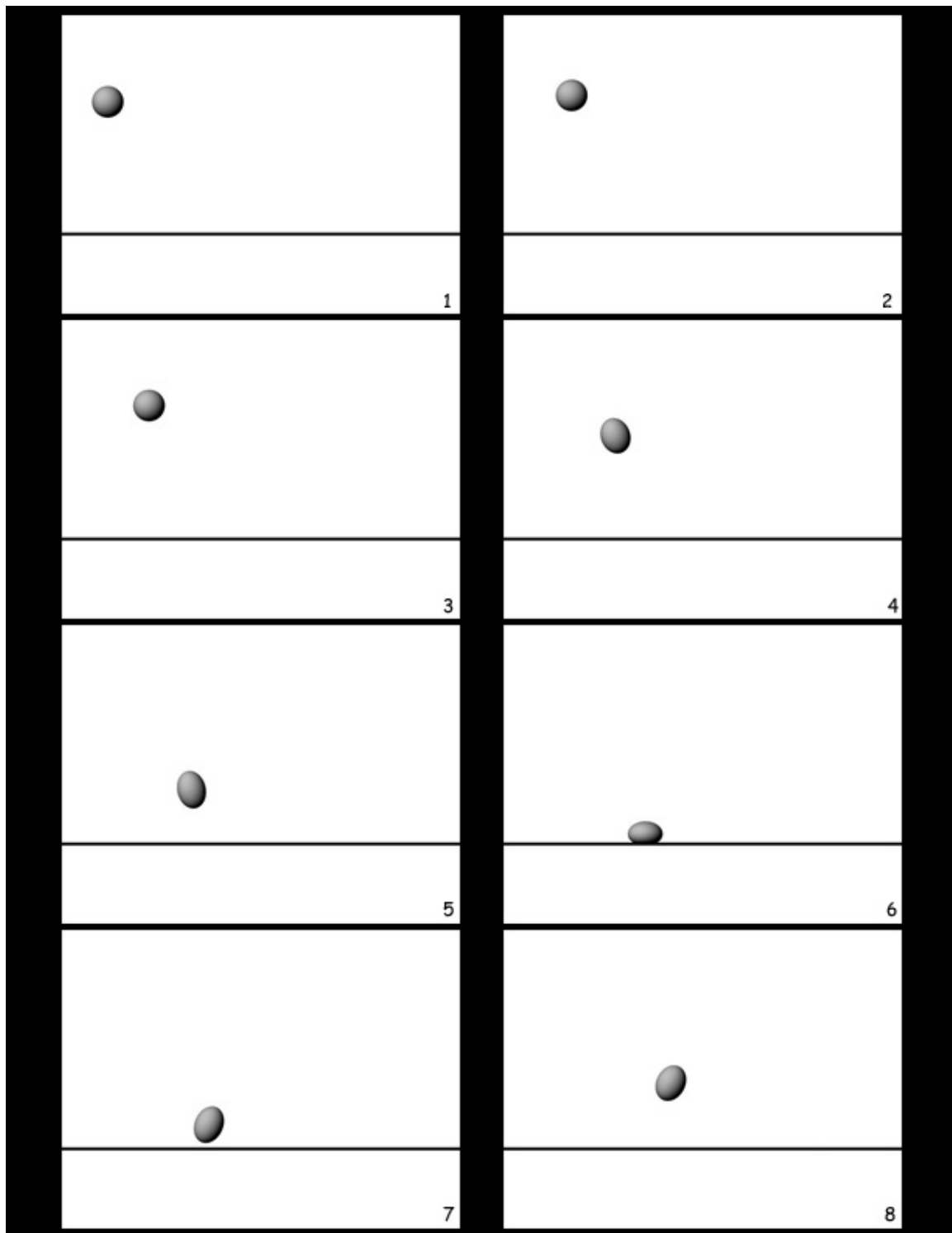


Drawings by Brock Ramirez
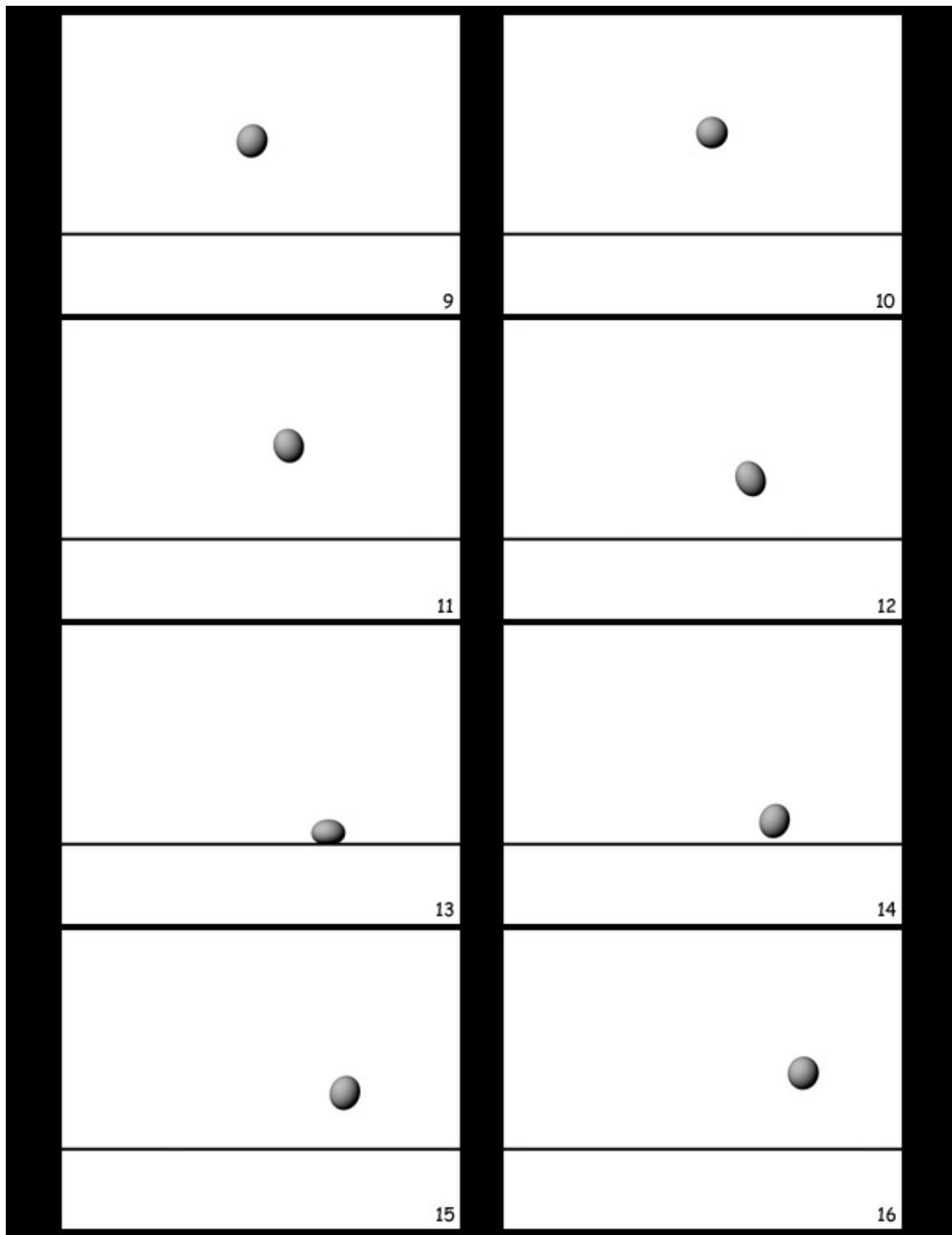
Drawings by Brock Ramirez

Drawings by Brock Ramirez
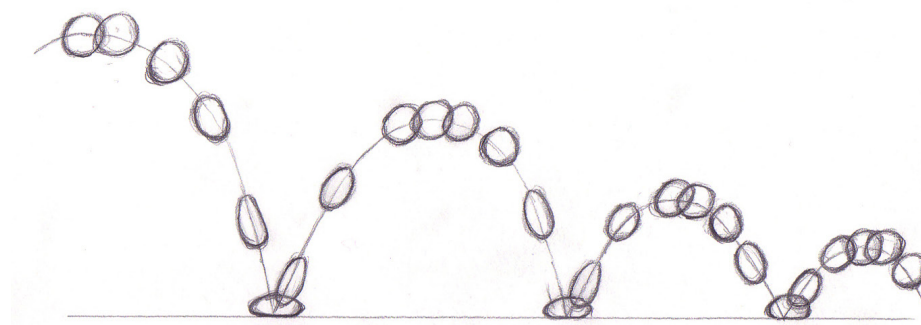
Drawings by Brock Ramirez

# Appendix C: Notes on the Bouncing Ball Straight-Ahead Animation

Use the information below to help you teach students how to use straight-ahead techniques to create a bouncing ball animation. The information is organized so that you can follow the same steps as in **Handout 6: Bouncing Ball Straight-Ahead Animation**.

## Step 1: Think about the path your ball will take.

Have students draw a path to use as a guide, starting in the upper left, falling to the bottom, and bouncing to the upper right.

Explain to students that this path is slightly different from the actual path an animator would use for a bouncing ball. Because students are looping the bounce, the ball is bouncing back to the same height. However, a ball would typically bounce less high on the second bounce (and on each subsequent bounce), as shown in the image below:



Drawing by Brock Ramirez

## Step 2: Plan for squash and stretch.

Have students think about a rubber ball bouncing on the floor and the shape that the ball might take when it hits the floor. Because a rubber ball is malleable, the force of the impact causes the ball to squash. Therefore, students' drawings of the ball at the point of impact should look similar to the following:
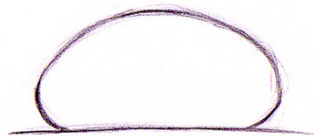


Drawing by Brock Ramirez

This is a "squashed" ball. Remind students that when they squash and stretch an object, *the volume of the object should remain the same*.

Students' drawings of the ball in the two frames right before it hits the floor and right after it leaves the floor should then be stretched. This makes the ball look as if it is moving faster and helps to give the ball a feeling of rubbery-ness:



Drawing by Brock Ramirez

Students might also stretch out the ball, to a lesser degree, in the frame or two before this one on the downward fall and after this one on the upward bounce. At the top part of the bounce, the ball should stay in a round ball shape.

## Step 3: Think about timing.

Students don't need to be exact with their timing, since they're doing straight-ahead animation. They should think in advance about how many frames in total they'll have for the animation. This is an area where students can experiment.

## Step 4: Start drawing your animation.

Have students number their sheets of paper in one corner before they begin working. Make sure that they are thinking about spacing and timing—they should draw more frames for the top of the arc (the beginning and end of the animation) and fewer frames as the ball gets closer to the ground (when it speeds up).

Remind students to incorporate *squash* and *stretch*. To maintain the same shape and volume for the round balls at the top of the arc, students should trace their first drawing for subsequent frames. (This may mean moving the drawing off of the pegs or unclipping it.)

Students should also refer to the round drawings of the ball when they draw their squashed and stretched balls, to make sure that they are maintaining the same volume.

## Step 5: Roll or flip your drawings as you work.

Rolling or flipping drawings is a crucial skill—it allows the animator to see what the work in progress looks like (before the pencil test stage) and to make corrections. Whether students roll or flip depends on whether the pegs (or clips or staples) are at the bottom or the top of the work, as well as the number of drawings they are working with.

For example, suppose your animation pegs are positioned at the bottom of the pages and you are right-handed. To roll your work:

- Put one sheet of paper between each finger of your left hand
- Roll the top left corners of the pages toward you and away from you as you reveal the set of drawings that you can see at one time.

For links to more information about rolling and flipping, see *Media & Resources*.


## Step 6: Do a pencil test.

Show students how to capture their drawings with either a camera or a scanner. Then show them how to use the software to create animations of their drawings and make loops. You can have students use holds to experiment with the timing.

# Appendix D: Interviewing Techniques

Interviewing is a great way to meet people and to learn information that you couldn't learn in another way. You may conduct your interviews in person, over the telephone, or using e-mail. Whichever method you choose, it's important to prepare in advance. Know what you plan to do during the interview and be prepared for any follow-up.

The following techniques, for use before, during, and after the interview, will help you get the most out of the experience.

## Preparing for the Interview

**Contact the interviewee.** Get in touch with the person you'd like to interview. Describe the purpose and length of your interview. Arrange a time to meet in person or to talk on the phone. If you plan to record your interview, ask for permission to do so in advance. If you plan to conduct the interview by e-mail, let the person know your timeframe for sending questions and receiving a response.

**Conduct research.** Do your homework! Look for information about the interviewee's company and the kind of work he or she does. Background information helps you focus and ask questions you might not have thought of.

**Think about topics.** Decide what information you want to get out of the interview. Remember, an interview is a chance to get information that you may not be able to find anywhere else. Make a list of the important points.

**List your questions.** Write a list of questions to ask, and ask your teacher or someone else to review them. Ask open-ended questions, rather than ones that can be answered with yes or no. For example, instead of "Do you like your job?" ask, "What parts of your job do you like most?"

**Order your questions.** Ask your questions in a logical sequence, from basic questions (for example, "Can you tell me about your experiences with 2-D animation?") to more specific questions (for example, "What do you think are the benefits of this new animation software?").

# During the Interview

**Dress appropriately.** If you're interviewing someone in person, dress for the situation. Always be clean and neat, and avoid clothes with logos, graphics, or sayings. To interview a businessperson, wear a nice pair of pants or a skirt and a button-down shirt or blouse.

**Arrive (or call) on time.** Don't keep your interviewee waiting. If you are using e-mail, be sure to send the questions on the day you arranged.

**Have the right gear.** Be prepared with a notebook and a pen or a pencil. If you are using a tape recorder or video camera, learn how all the controls work before you arrive and give yourself a few extra minutes to set up the equipment.

**Warm up.** Always begin by thanking the person for his or her time. If your interview is in person or on the phone, spend a few minutes to get acquainted before you ask your questions. (For example, you might ask whether the person has been interviewed about his or her career before, or briefly explain this research project.) However, in an e-mail, after thanking the person for his or her time, it's best to get right to the point.

**Let the interviewee do the talking.** Don't interrupt, and be sure to give the person time to answer each question. Use pauses as a chance to take notes, rather than moving straight to the next question. You should also practice active listening—make eye contact and show your interest by nodding your head and making appropriate comments, such as "Uh-huh" and "I see."

**Take notes.** If you're not recording the interview, take detailed notes on your interviewee's responses, writing down key information. Be sure to note important or interesting phrases that you may want to quote. The notes are for you to remember the interview later; you do not need to use full sentences or write down every word. You may want to practice taking notes before your interview.

**Ask follow-up questions.** If an answer makes you think of another question, go ahead and ask it. Don't be afraid to ask questions to clarify your interviewee's answers or to get more information, such as "Can you give me an example?" or "Does that mean that _____?" For e-mail interviews, you may send a second message with follow-up questions based on the interviewee's responses.

**Wrap up.** At the end of the interview, thank the interviewee again. Ask if it would be OK to call or e-mail if you have any further questions. Offer to send a copy of your final report or product—and be sure to follow through!

# After the Interview

**Thank your interviewee.** Send an e-mail or a card thanking the person for the information he or she shared.

**Review your notes.** As soon as possible after the interview, read your notes and add any information you remember from the interview but didn't write down at the time. (The sooner you do this the better, as your memory of the conversation will help you make sense of your notes.) You may want to type them and organize them. Write down any additional questions that you have.

**If necessary, follow up.** If your interviewee has agreed, ask follow-up questions in a phone call or an e-mail. Thank the interviewee for this additional time.

**Evaluate the interview.** Reflect on the interview process. What went well? What didn't go well? What will you change the next time you conduct an interview? Write down your reflections in your journal.

# Appendix E:
# Sample Character Designs

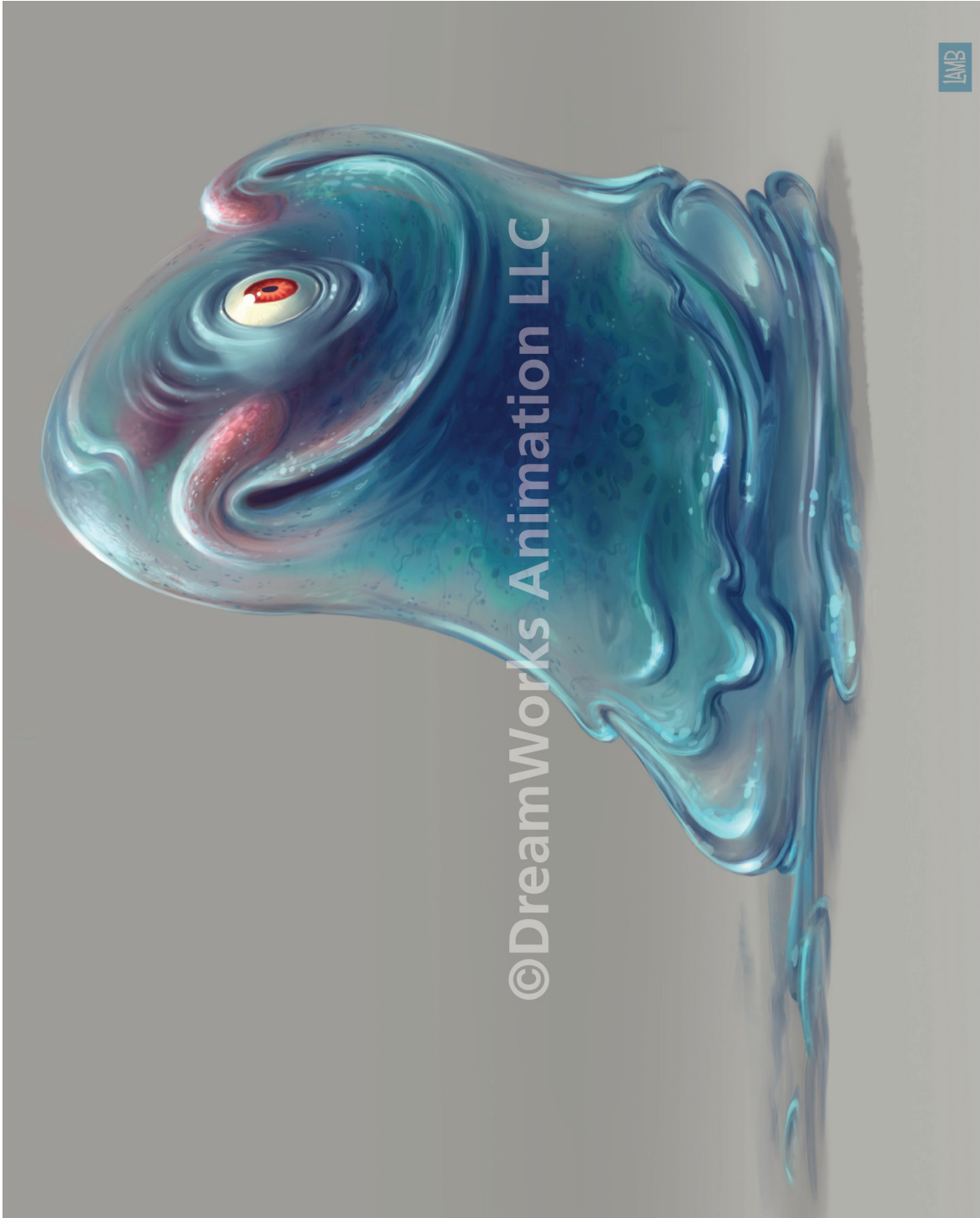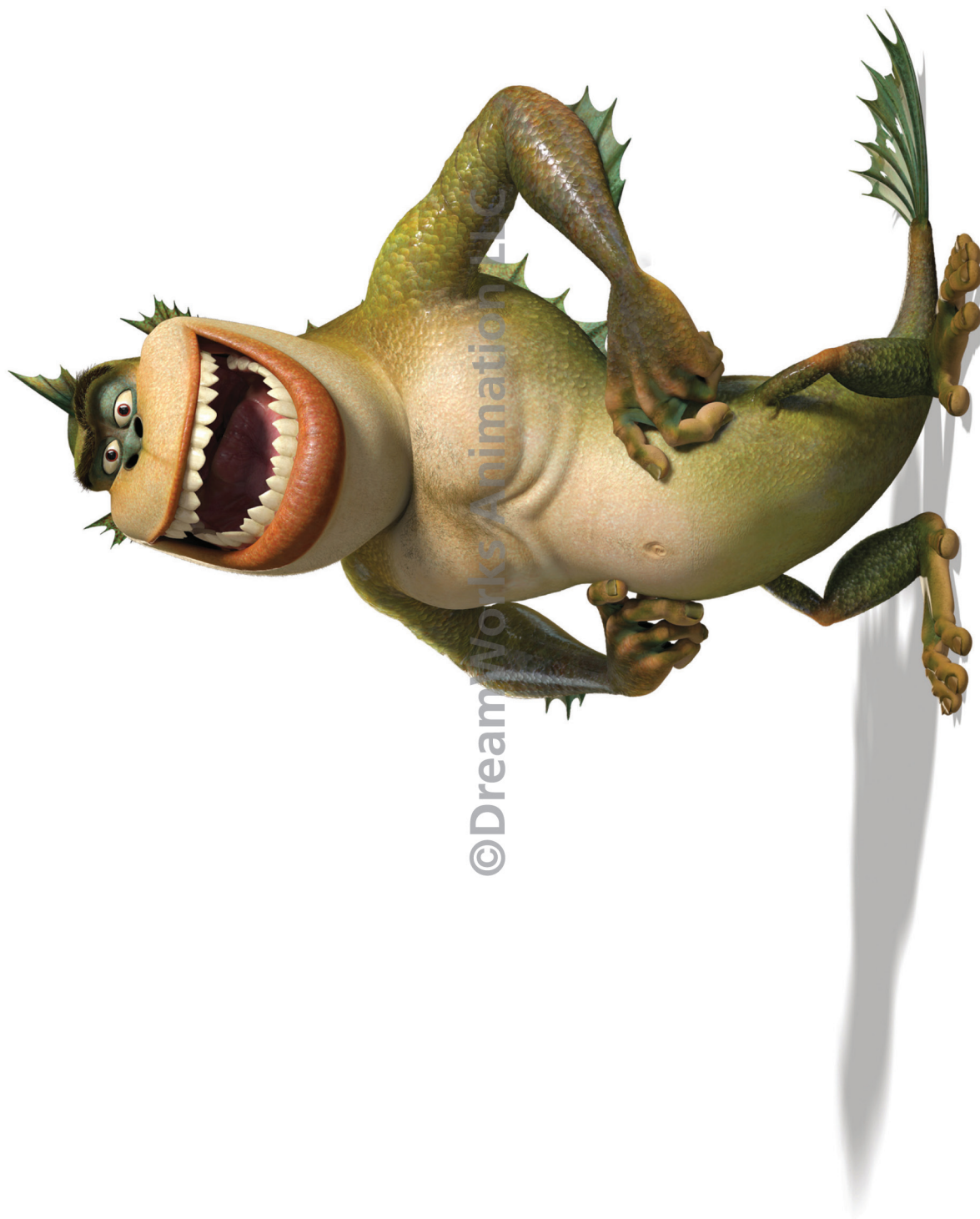You can share the following character studies and model sheets with students.



Character studies of Po from *Kung Fu Panda*. Image courtesy of DreamWorks LLC.

Character studies of Po from *Kung Fu Panda*. Image courtesy of DreamWorks LLC.

Model sheet of B.O.B. from *Monsters vs. Aliens*. Image courtesy of DreamWorks LLC.

Model sheet of The Missing Link from *Monsters vs. Aliens*. Image courtesy of DreamWorks LLC.

# Materials Needed

## Throughout the Unit

- Equipment for playing movies, such as a DVD player and monitor
- Chart paper and markers

## Part 1: Introduction to Animation

*Art Supplies and Other Equipment*

- Digital cameras and tripods (1 of each per team)
- Pennies (1 per team)
- White paper (8½ x 11 inches or larger—2 sheets per team)
- Optional: Clear tape, wall putty, or other adhesive (if teams will photograph the penny on a wall instead of on a table)
- Software for creating stop-motion animations (see *Advance Preparation*)
- Optional: Dry-erase marker
- List of links to online animated clips (see *Advance Preparation*)
- Optional: Flipbooks made from the illustrations in **Appendix B: Flipbook Pages** (see *Advance Preparation*)
- Erasers
- Peg bars and punched animation paper or thin sheets of paper that are clipped or stapled together at the top and taped to students' desks
- Optional: Light tables
- Digital cameras or scanners
- Computers (ideally, 1 for each student)
- Software for creating pencil tests (see *Advance Preparation*)
- Software for creating 2-D computer-generated animation (see *Advance Preparation*)
- Optional: Step-by-step instructions, how-to guides, or user manuals for the 2-D animation software

*Handouts*

- **Handout 1: Unit 1 Overview**
- **Handout 2: Animating a Bouncing Penny**
- **Handout 3: Principles of Animation #1**
- **Handout 4: Elements of Art and Principles of Design**
- **Handout 5: Weekly Critique** (multiple copies per student)
- **Assessment Checklist 1: Weekly Critique** (multiple copies per student)
- **Handout 6: Bouncing Ball Straight-Ahead Animation**
- **Handout 7: Bouncing Ball Pose-to-Pose Animation**
- **Handout 8: The Critical Response Process**
- **Handout 9: Unit 1 Journal Assignments**
- **Handout 10: Unit 1 Career Information**
- **Handout 11: Career Profile Project**
- **Assessment Checklist 2: Career Profile Project**

*Examples of Media Resources*

- Short clip from a familiar animated movie (see *Advance Preparation*)
- Two short animated movie clips that demonstrate four principles of animation (see *Advance Preparation*)

*Advance Preparation*

- Select a short, engaging clip from an animated movie that students are familiar with. (See *Media & Resources* for suggestions.)
- Before Activity 1A.2, select software that students will use for creating stop-motion animations of their pennies. (See *Media & Resources* for software suggestions.) Test the penny animation process to make sure that the equipment and software work properly and to identify points during the process when students may need help.
- Before Activity 1A.3, select two short animated 2-D movie clips that each demonstrate the four principles of animation described on Handout 3: squash and stretch, slow in and slow out, arcs, and timing. (See *Media & Resources* for suggestions.) View the clips and identify the ways that they use these principles.

---

**Note:** Sample analyses of *Sleeping Beauty* are provided in the Teacher's Notes in Activities 1A.3 and 1A.4.

---

- Before Activity 1A.4, prepare a list of links to online animated clips for students to view on their own for the weekly critique assignment. (See *Media & Resources* for suggestions.)
- Optional: Create three flipbooks using the pages provided in **Appendix B: Flipbook Pages**:
  - Make three copies of pages 1–17 and one copy of each remaining page.
  - Put together one set of pages 1–17, in order, and staple them on the left-hand side. This is flipbook #1.
  - Put together the second copy of pages 1–17, replacing pages 2, 4, 8, 11, 13, 15, and 17 with v2, v4, v8, v11, v15, and v17. Staple them on the left-hand side. This is flipbook #2.
  - Put together the third copy of pages 1–17, replacing pages 5, 8, 11, 13, 14, and 16 with a5, a8, a11, a13, a14, and a16. Staple them on the left-hand side. This is flipbook #3.
- Determine the equipment that you will have students use to draw their animations. Ideally, students will use peg boards and punched animation paper. However, students can also use sheets of animation paper that have been stapled or clipped together at the top and then taped to their desks. Light tables can make animation work easier but are not required.
- If students are creating computer-generated or stop-motion animations, determine the equipment they will need, such as drawing tablets or cameras.

- Before Activity 1B.1, become familiar with the technique of "rolling" or "flipping" drawings in order to check what an animation looks like. (See *Media & Resources* for links to tutorials.)
- Determine whether students will capture their drawings by scanning them or by taking digital photographs, and then select the appropriate software for creating their pencil tests. (See *Media & Resources* for software options.)
- Select software for creating 2-D computer-generated animations. (See *Media & Resources* for software options.) Depending on how you plan to instruct students in using the 2-D animation software, you may want to create or locate step-by-step instructions, how-to guides, or user manuals.

## Part 2: Finding the Right Story

*Art Supplies and Other Equipment*

- Computers with Internet access and printers
- Paper
- Erasers
- Optional: Mirrors
- Tools for drawing animation frames, for example:
  - Erasers
  - Peg bars and punched animation paper or thin sheets of paper clipped or stapled together at the top and taped to students' desks
  - Optional: Light tables

  **Note:** Each student will need 34 sheets of paper for the walk cycles, plus additional paper for sketches and timing charts.

- Digital cameras or scanners
- Software for creating pencil tests

*Handouts*

- **Handout 12: Unit 1 Project Description**
- **Assessment Checklist 3: Unit Project—Character Design**
- **Handout 13: Story Description**
- **Handout 14: About Review Groups**
- **Assessment Checklist 4: Unit Project—Review Group**
- **Handout 15: Scene and Moment Worksheet**
- **Handout 16: Principles of Animation #2**
- **Handout 17: Character Description Worksheet**
- **Handout 18: Animating a Walk Cycle**
- Copies of **Assessment Checklist 4: Unit Project—Review Group**

*Examples of Media Resources*

- Short clip of an animated movie based on a fairy tale, myth, or short story (see *Advance Preparation*)
- Selection of fairy tales, folktales, myths, and short stories (see *Advance Preparation*)
- Short animated movie clip that demonstrates the animation principles of *follow-through and overlapping action* and *appeal* (see *Advance Preparation*)
- Sample turnaround sheets (see *Advance Preparation*)
- Sample character studies showing expression (see *Advance Preparation*)
- Sample model sheets (see *Advance Preparation*)
- Optional: Clips of pencil tests showing simplified characters (see *Advance Preparation*)
- Animated clip(s) with examples of walk cycles (see *Advance Preparation*)

*Advance Preparation*

- Select a short clip from an animated movie that retells a fairy tale, myth, folktale, or short story. See *Media & Resources* for suggestions.
- Work with an ELA teacher to provide an interesting selection of short stories, myths, folklore, and/or narrative poems for students to read and choose from. Decide whether students will read (or listen to) the stories in your class, in ELA class, or on their own. Set aside additional time if students are reading or listening to stories during your class time.
- If having students select stories is too challenging or if time is limited, you can pre-select one story for the class and have students focus on the same scene and moment. You can also have students choose from among three or four stories that you've selected.
- Students should have experience developing and drawing characters before completing this activity. If students have not taken *D/M/A Foundations in Visual Arts, Unit 5: Creating Characters*, determine which activities from Unit 5 you will use to introduce students to the process of character development. You might have students complete the character analysis at the beginning of the unit (Activity 1A.1), introduce them more fully to how to create turnaround sheets (Activity 1B.3) and character studies (Activity 2B), and analyze the style of different animation houses (Activity 2A.2).
- Before Activity 2B.1, select a short animated movie clip that demonstrates the animation principles of *follow-through and overlap* and *appeal* (see Handout 16 for more information about these principles). See *Media & Resources* for animated movie suggestions.

  **Note:** A sample analysis of the use of these principles in Disney's *Snow White* is provided in Activity 2B.1.

- In Activities 2B.2 and 2B.3, students look at samples of turnaround sheets, character studies, and model sheets. For Activity 2B.2, prepare

a set of sample turnaround sheets and sample character studies. For Activity 2B.3, prepare a set of sample model sheets. See **Appendix E: Sample Character Designs** and *Media & Resources* for links to examples.

---

**Note:** A sample analysis of a character study sheet for Po, a character from *Kung Fu Panda*, is provided in Activity 2B.2.

---

- For Activity 2B.3, if you plan to show students clips from pencil tests that use simplified versions of characters, select the clips you will use. See *Media & Resources* for suggestions.
- Obtain a copy of the animated movie *Robin Hood* or another movie that contains examples of walk cycles for several different kinds of characters (e.g., heavy and light, tall and short, male and female). Select the clip you will show students. (The opening sequence in *Robin Hood* provides good examples of walk cycles.) You can also select clips from two different movies to compare walk cycles.

## Part 3: Creating the Animation

*Art Supplies and Other Equipment*

- Paper for storyboarding (several sheets per student)
- Optional: Stopwatches
- Erasers
- Peg bars and punched animation paper or thin paper clipped or stapled together at the top and taped to students' desks
- Optional: Light tables
- Digital cameras or scanners
- Computers (1 for each student)
- Software for creating pencil tests
- Software for creating 2-D computer-generated animation

*Handouts*

- **Handout 19: Principles of Animation #3**
- **Handout 20: Making Storyboards**
- **Assessment Checklist 5: Unit Project—Moment Storyboard**
- **Assessment Checklist 6: Unit Project—Completed Animation**
- Copies of **Assessment Checklist 4: Unit Project—Review Group**

*Examples of Media Resources*

- Clip from an animated movie (see *Advance Preparation*)
- Sample storyboards (see *Advance Preparation*)

*Items Students Need to Bring*

- Students' copies of Handouts 3 and 16
- Students' copies of Handout 14
- Students' storyboards of their chosen moment
- Students' simplified character designs
- Optional: Students' copies of Handout 7
- Students' digitally captured drawings for their animated moment (created for their pencil test in Activity 3B)
- Students' copies of Assessment Checklist 6

*Advance Preparation*

- Before beginning Part 3, students should also be familiar with the visual conventions of movies (such as types of shots, angles, and camera movements). If they have not taken *D/M/A Foundations in Media and Digital Design, Unit 2: Telling Stories with Moving Images*, give them **Handout 3: The Language of Cinematography** from that unit. You can also have students analyze a clip from a movie (live-action or animated) as described in Activity 1B: Tools of the Visual Storyteller (also from Unit 2).
- Before Activity 3A.1, select a short animated movie clip that demonstrates the animation principles of *anticipation*, *staging*, *secondary action*, and *exaggeration* (see **Handout 19: Principles of Animation #3** for more information). See *Media & Resources* for animated movie suggestions.

  ---

  **Note:** A sample analysis of the use of these principles in Disney's *Fantasia* is provided in Activity 3A.1.

  ---

- Before Activity 3A.2, gather several sample storyboards—ideally, including some from animated movies—to show the class. See *Media & Resources* for suggestions.
- For Activity 3A.2, students should be familiar with the process of creating storyboards. If students do not have prior experience with storyboards, you can have them complete storyboarding activities from *D/M/A Foundations in Visual Arts, Unit 3: Community Stories*, such as storyboarding a scene from an existing movie (Activity 3A.1).

## Part 4: Pitching the Work

*Handouts*

- **Handout 21: The Pitch**
- **Assessment Checklist 7: Unit Project—Pitch**

*Items Students Need to Bring*

- Optional: Students' completed copies of Handouts 13, 15, and 17
- Students' portfolios, including their turnaround sheets, character studies, model sheet, storyboard of a moment, and final animation

*Advance Preparation*

- If you have invited AME professionals to attend the pitch session in Activity 4B, confirm the arrangements with them.

# Media & Resources

These recommended Web sites have been checked for availability and for advertising and other inappropriate content. However, because Web site policies and content change frequently, we suggest that you preview the sites shortly before using them.

*Media & Resources* are also available at http://dma.edc.org and at http://dmamediaandresources.pbworks.com, a Wiki that allows users to add and edit content.

# General Animation Resources

The following books and Web sites contain in-depth information about the process of animation. You may also wish to look at books that cover animating with the software your class is using (these are not included here because software programs change so frequently).

## Books

Blair, P. (1994). *Cartoon animation*. Irvine, CA: Walter Foster.

Camara, S. (2006). *All about techniques in drawing for animation production*. Hauppauge, NY: Barron's Educational Series.

Hooks, E. (2003). *Acting for animators (Rev. ed.): A complete guide to performance animation*. Portsmouth, NH: Heinemann Drama.

Romanelli, D. (2005). *Draw the Looney Tunes*. San Francisco: Chronicle Books.

Thomas, F., & Johnston, O. (1981). *The illusion of life*. New York: Disney Editions.

Whitaker, H., & Halas, J. (2002). *Timing for animation*. Oxford: Focal Press.

White, T. (2009). *How to make animated films*. Oxford: Focal Press.

Williams, R. (2009). *The animator's survival kit: Expanded edition*. London: Faber and Faber.

## Web Sites

Academy of Art Animation Notes [Includes links to sources for hand-drawn animation equipment]
> hand-drawn-animation.blogspot.com

Animation Mentor
> www.animationmentor.com

The Eleven Second Club [Hosts of a monthly animation competition]
> www.11secondclub.com

Idleworm animation tutorials

www.idleworm.com/how/index.shtml

Larry's Toon Instititue

tooninstitute.awn.com/main.html

Lynda.com animation software tutorials

www.lynda.com

## Glossaries

3DRender.com. *Glossary of 3D Terms*.

www.3drender.com/glossary/index.htm

Skillset. *Animation Glossary*.

www.skillset.org/animation/careers/article_4487_1.asp

## Overview of the Animation Process

DreamWorks. Go to "Company," then click "Production Process."

www.dreamworksanimation.com/

Pixar. *How We Make a Movie: Pixar's Animation Process.*

www.pixar.com/howwedoit/index.html#

Skillset. *Putting It Together: How Animation Gets Made.*

www.skillset.org/animation/overview/article_3768_1.asp

## Stop-Motion Photography and Slow-Motion Video

The following resources can be used to show students how objects in the real world move, squash, and stretch.

Kayafas, G., & Jussim, E. (2000). *Stopping time: The photographs of Harold Edgerton*. New York: Harry N. Abrams.

Muybridge, E. (1985). *Horses and other animals in motion: 45 classic photographic sequences*. New York: Dover Publications.

*YouTube*
Searching for "High FPS" brings up video clips shot at a very high frame rate and played in slow motion.

www.youtube.com

# Career Connections

## Interviews

Animated Views: Interview Archives. Interviews with directors, artists, composers, and filmmakers.

animatedviews.com/category/interviews/

### Lead Animator/Supervising Animator

Interview with Scott Clark, supervising animator at Pixar

www.allartschools.com/faqs/animator-profile

Radio interview with Shawn Kelly, ILM lead animator, *Transformers: Revenge of the Fallen*

animatedlim.blogspot.com/2009/06/shawn-kelly-interview-on-alice973.html

Interview with Starling Allen, lead animator for *A Scanner Darkly*

www.layersmagazine.com/vector-art-goes-hollywood.html

Interview with Daniel Lilleberg, Global Agenda lead animator

www.tentonhammer.com/node/73916

Multi-part interview with Mark Henn, supervising animator, *The Princess and the Frog*

animatedviews.com/2009/the-princess-and-the-frogs-supervising-animator-mark-henn-a-career-retrospective

### Animator

Interview with Gini, animator at Pixar

www.pixar.com/artistscorner/gini/interview.html

Interview with Sanjay, animator at Pixar

www.pixar.com/artistscorner/sanjay/interview.html

### Lighter/Lighting Technical Director/Lighting Animator

Interview with Neil, a technical director at Pixar

www.pixar.com/artistscorner/neil/interview.html

Interview with Vanitha Rangaraju, lighting technical director for Pacific Data Imaging/DreamWorks, *Shrek*, *Shrek 2*, and *Shrek 3*

www.islamonline.net/servlet/Satellite?c=Article_C&cid=1178724250713&pagename=Zone-English-HealthScience%2FHSELayout

Interview with Dennis Muren, excerpted from *Inspiring 3D: Lighting and Compositing* by David Parish (Cincinnati, OH: Premier Press, 2002)

www.awn.com/articles/technology/iinspired-3d-lighting-and-compositingi-interview-dennis-muren/page/1%2C1

### Storyboard Assistant/Production Assistant

Interview with Chris Belcher, production assistant intern at Nickelodeon Studios for *Penguins of Madagascar*

aidallasalumni.blogspot.com/2010/02/chris-belcher-nickelodeon-intern.html

### Storyboard Artist

Interview with Joe, storyboard artist at Pixar

www.pixar.com/artistscorner/joe/interview.html

Interview with Christian DeVita, storyboard artist, *Fantastic Mr. Fox*
hdrawn.ca/2009/11/09/an-interview-with-fantastic-mr-fox-storyboard-artist-christian-devita/
Interview with Federico D'Alessandro, storyboard artist, *Where the Wild Things Are*
www.smashboxstudios.com/yello/?p=858

Interview with Enrico Casarosa, storyboard artist, *Ratatouille*
animatedviews.com/2007/enrico-casarosa-on-storyboarding-ratatouille

## Other Career Resources

ConnectEd Studios includes "day-in-the-life" videos of industry professionals as well as a database of individuals who have volunteered to be available to teachers and students for their media projects.
connectedstudios.org

Made in Hollywood, Teen Edition. Interviews with movie industry professionals, including some who work in animation.
www.madeinhollywood.tv/teenedition.html

Skillset Careers: Working in Animation.
www.skillset.org/animation/careers

# Part 1: Introduction to Animation

## Activity 1A.1: Why Animation?

Students may be familiar with a variety of animated movies. You can show students:

- classic movies, such as *Snow White* or *Bambi*
- contemporary movies that are considered classics, such as *Toy Story* or *Mulan*
- movies that have been released in the last year or two that students may have seen in theaters

## Activity 1A.2: Animating a Penny

Various software programs can be used to create stop-motion animations, including the following.

Beautiful Motion (free)
www.fourchambers.org/fcs_stop_motion_animation_software.php

Frame by Frame
web.mac.com/philipp.brendel/Software/FrameByFrame.html

iMovie

---

**Note:** If you use iMovie, you may need to disable transitions that are automatically applied when still photographs are played.

---

www.apple.com/ilife/imovie/

iStopMotion

www.boinx.com/istopmotion/overview

Stop Motion Pro

www.stopmotionpro.com/

## Activity 1A.3: Seeing the Principles of Animation at Work

Any of the classic Disney animated movies should incorporate the animation principles discussed in this activity. Some examples are listed below.

*Bambi*

*Cinderella*

*Fantasia*

*Lady and the Tramp*

*Sleeping Beauty* (used for sample analyses in unit)

*Snow White and the Seven Dwarfs*

## 1A.4: Looking at the Elements of Art and Principles of Design

### Sites with Animation Clips

Cartoon Network. Links to clips and full episodes of animated TV shows.

www.cartoonnetwork.com/video/index.html

Kids WB. Links to video clips, including clips of classic Looney Tunes cartoons.

www.kidswb.com/

PBS Kids. Links to clips and full episodes of animated TV shows.

pbskids.org/

YouTube

www.youtube.com

Wallace and Gromit. Links to clips of stop-motion animation.

www.wallaceandgromit.com/

### Information About Steamboat Willie

Disney: *Steamboat Willie*

disney.go.com/vault/archives/movies/steamboat/steamboat.html

The Encyclopedia of Disney Animated Shorts: *Steamboat Willie*

www.disneyshorts.org/years/1928/steamboatwillie.html

YouTube video of *Steamboat Willie*

www.youtube.com/watch?v=BBgghnQF6E4


## Activity 1B: Follow the Bouncing Ball

### Rolling or Flipping Drawings

Flipping and Rolling: An Animation Skill

frankg-animator.blogspot.com/2009/08/flipping-and-rolling-animation-skill.htm

Idleworm Bouncing Ball Tutorial

www.idleworm.com/how/anm/01b/bball.shtml

Video of flipping

www.youtube.com/watch?v=ALbKISkJzco

Videos of rolling

www.youtube.com/watch?v=nFFq_-XCfq4rainplace.net/?p=234


### Software for Creating Pencil Tests

You can use the stop-motion animation software you used in Activity 1A.2 to create pencil tests, using either digital photographs of the drawings or scanned images. Other programs that you can use to create pencil tests are listed below.

Flipbook

www.digicelinc.com/

Toonboom Pencil Check Pro

www.toonboom.com/products/pencilcheckpro/takeATour/


### Software to Make 2-D Digital Animations

Adobe Flash

www.adobe.com/products/flash/

Flipbook

www.digicelinc.com/

Pencil (free)

www.pencil-animation.org/

Toonboom

www.toonboom.com/main/

# Part 2: Finding the Right Story

## Activity 2A.1: Choosing a Story

Some examples of animated movies based on fairy tales, myths, folktales, or short stories are listed below.

*Aladdin*

*Cinderella*

*Fantastic Mr. Fox* (stop-motion animation)

*How the Grinch Stole Christmas*

*Little Mermaid*

*Shrek*

*Sleeping Beauty*

*Snow White*

## Activity 2B.1: Initial Character Design

### Clips Demonstrating Follow-Through and Overlap and Appeal

Most animated movies will include examples of these two principles. You might show students examples of earlier Disney shorts featuring characters such as Goofy, Donald Duck, or Mickey Mouse. The example in the unit is a clip from *Snow White*, another good choice.

## Activity 2B.2: Creating Turnaround Sheets and Character Studies

### Sample Turnaround Sheets

DC Cartoon Archives Model Sheets

    http://dcanimated.toonzone.net/Model%20Sheets/modmain.htm

Don Bluth Turnaround Model Sheets

    www.donbluthanimation.com/_Don_Bluth_Animation_Cyber_Garage_ Project_turnaround_model_sheets.html

How to Draw Elfquest: Character Charts

    www.elfquest.com/fun/CharModels2.html

Klasky Csupo Animation Lessons: Turnarounds

    www.cooltoons2.com/various/artlessons/turnarounds.html

Teen Titans Art and Design: Original Turnarounds and Model Sheets

    www.titanstower.com/source/animated/artmodelsheets.html

**Sample Character Studies Showing Expression**

The following character studies were lent from the Van Eaton Galleries to the ASIFA-Hollywood Animation Archive (www.animationarchive.org/2006/09/media-two-disney-concept-artists.html).

Character Design Blogspot: From Concept to Final. Round 5 (*The Jungle Book*)

Character studies for the characters of Shere Khan, The Monkey, and The Girl

> http://characterdesign.blogspot.com/search?q=Jungle+Book

*Baby Pegasus, from Concert Feature F-128*

Albert Hurter

> www.animationarchive.org/pics/concept07-big.jpg

*Jiminey Cricket Undersea—Seq. 10, from Pinocchio F-3*

Albert Hurter

> www.animationarchive.org/pics/concept03-big.jpg

The following character studies were lent from the Van Eaton Galleries to the ASIFA-Hollywood Animation Archive (www.animationarchive.org/labels/model%20sheet.html).

*Donald Duck, from Production 2043*

Bill Roberts

> www.animationarchive.org/pics/miceduck07-big.jpg

*Unititled* (Minnie and Mickey Mouse)

> www.animationarchive.org/pics/miceduck01-big.jpg

*Donald's Date* (Daisy and Donald Duck)

> www.animationarchive.org/pics/miceduck11-big.jpg

The following character studies were lent from the Van Eaton Galleries to the ASIFA-Hollywood Animation Archive (http://www.animationarchive.org/2006/08/media-reluctant-dragon-and-pinocchio.html).

*Model Sheet Pinocchio F-3*

> www.animationarchive.org/pics/model106-big.jpg

*The Art of Miyazaki's Spirited Away* (book)

Hayao Miyazaki
You can find sample pages of the book, including character studies of Chihiro Ogino, online.

> http://animeaffairs.wordpress.com/2008/08/10/the-art-of-miyazakis-spirited-away/

# Activity 2B.3: Finalizing the Character Design

**Sample Model Sheets**

About.com Animation Character Sheet

> http://animation.about.com/od/otherusefultutorials/ss/charactersheet.htm

Animationmeat.com Model Sheets
This site includes model sheets, turnarounds, and character studies showing action and expression.

www.animationmeat.com/modelsheets/modelsheets.html

The Unofficial Disney Animation Archive: Model Sheets
This site includes both model sheets and character studies showing action and expression.

animationarchive.net/Model%20Sheets/index.php

### Pencil Tests

(Note that some pencil tests may be more "finished" than others—show students tests that use simplified character designs.)

Academy of Art Animation Notes: Classic Milt Kahl Pencil Test

hand-drawn-animation.blogspot.com/2009/04/classic-milt-kahl-pencil-test.html

Pencil Test Depot

www.penciltestdepot.com/

X-sheet Videos

xsheetvideos.blogspot.com

# Part 3: Creating the Animation

## Activity 3A.1: More Principles of Animation

Most good animated movies will include examples of anticipation, exaggeration, staging, and secondary action. Again, you might show students classic Disney films—*Fantasia* in particular has some excellent and dramatic staging. Hayao Miyazaki's movies (such as *Princess Mononoke*) also include dramatic staging. For exaggeration, good examples include short animations by Tex Avery and Looney Tunes.

## Activity 3A.2: Storyboarding the Moment

### Sample Storyboards

Animatics & Storyboards, Inc., Storyboard Samples

www.storyboards-east.com/storybrd.htm

Josh Sheppard Storyboard Samples

www.thestoryboardartist.com/Site/Film.html

Pixar's *Up* Storyboards

characterdesign.blogspot.com/2009/05/pixars-up-storyboards.html

Storyboards, Inc.

www.storyboardsinc.com

# Standards

This unit was developed to meet the following standards.

## Career and Technical Education AME Industry Sector Foundation Standards

### 2.2 Writing

**1.6** Develop presentations by using clear research questions and creative and critical research strategies (e.g., field studies, oral histories, interviews, experiments, electronic sources).

### 3.0 Career Planning and Management

Students understand how to make effective decisions, use career information, and manage personal career plans:

**3.1** Know the personal qualifications, interests, aptitudes, knowledge, and skills necessary to succeed in careers.

**3.2** Understand the scope of career opportunities and know the requirements for education, training, and licensure.

### 4.0 Technology

Students know how to use contemporary and emerging technological resources in diverse and changing personal, community, and workplace environments:

**4.2** Understand the use of technological resources to gain access to, manipulate, and produce information, products, and services.

**4.4** Understand digital applications appropriate to specific media and projects.

**4.5** Know the key technological skills appropriate for occupations in the arts industry.

**4.6** Know how technology and the arts are interrelated in the development of presentations and productions.

**4.7** Understand how technology can reinforce, enhance, or alter products and performances.

### 5.0 Problem Solving and Critical Thinking

Students understand how to create alternative solutions by using critical and creative thinking skills, such as logical reasoning, analytical thinking, and problem-solving techniques:

**5.1** Apply appropriate problem-solving strategies and critical thinking skills to work-related issues and tasks.

**5.3** Use critical thinking skills to make informed decisions and solve problems.

**5.4** Use the elements of the particular art form to observe, perceive, and respond.

**5.5** Understand the application of research and analysis skills to the creation of content.

## 7.0 Responsibility and Flexibility

Students know the behaviors associated with the demonstration of responsibility and flexibility in personal, workplace, and community settings:

**7.1** Understand the qualities and behaviors that constitute a positive and professional work demeanor.
**7.2** Understand the importance of accountability and responsibility in fulfilling personal, community, and workplace roles.
**7.3** Understand the need to adapt to varied roles and responsibilities.
**7.4** Understand that individual actions can affect the larger community.
**7.7** Develop a personal commitment to and apply high-quality craftsmanship to a product or presentation and continually refine and perfect it.

## 9.0 Leadership and Teamwork

Students understand effective leadership styles, key concepts of group dynamics, team and individual decision making, the benefits of workforce diversity, and conflict resolution:

**9.3** Understand how to organize and structure work individually and in teams for effective performance and the attainment of goals.
**9.5** Understand how to interact with others in ways that demonstrate respect for individual and cultural differences and for the attitudes and feelings of others.
**9.7** Cultivate consensus, continuous improvement, respect for the opinions of others, cooperation, adaptability, and conflict resolution.

## 10.0 Technical Knowledge and Skills

Students understand the essential knowledge and skills common to all pathways in the Arts, Media, and Entertainment sector:

**10.6** Know the appropriate skills and vocabulary of the art form.
**10.7** Understand and analyze the elements of the art form.
**10.10** Use technical applications in the creative process, where appropriate.
**10.12** Use a variety of strategies (e.g., personal experience, discussion, research) to comprehend, interpret, evaluate, and appreciate source and technical documents and materials.

## 11.0 Demonstration and Application

Students demonstrate and apply the concepts contained in the foundation and pathway standards.

# Career and Technical Education AME Industry Sector Media and Design Arts Pathway Content Standards / VPA Visual Arts Content Standards

- Identify and use the principles of design to discuss, analyze, and write about visual aspects in the environment and in works of art, including their own. [AME A1.1(1.1), VPA 1.1]
- Research and analyze the work of an artist and write about the artist's distinctive style and its contribution to the meaning of the work. [AME A1.1(1.3), VPA 1.3]
- Analyze and describe how the composition of a work of art is affected by the use of a particular principle of design. [AME A1.1(1.4), VPA 1.4]
- Compare and contrast similar styles of works of art done in electronic media with those done with materials traditionally used in the visual arts. [AME A1.1(1.6), VPA 1.6]
- Solve a visual arts problem that involves the effective use of the elements of art and the principles of design. [AME A1.2(2.1), VPA 2.1]
- Prepare a portfolio of original two- and three-dimensional works of art that reflects refined craftsmanship and technical skills. [AME A1.2(2.2), VPA 2.2]
- Develop and refine skill in the manipulation of digital imagery (either still or video). [AME A1.2(2.3), VPA 2.3]
- Review and refine observational drawing skills. [AME A1.2(2.4), VPA 2.4]
- Identify and describe the role and influence of new technologies on contemporary works of art. [AME A1.3(3.2), VPA 3.2]
- Articulate the process and rationale for refining and reworking one of their own works of art. [AME A1.4(4.4), VPA 4.4]
- Employ the conventions of art criticism in writing and speaking about works of art. [AME A1.4(4.5), VPA 4.5]
- Demonstrate an understanding of the various skills of an artist, art critic, art historian, art collector, art gallery owner, and philosopher of art (aesthetician). [AME A1.5(5.4), VPA 5.4]

## A2.0 Technical Requirements

Students understand the key technical and technological requirements applicable to various segments of the Media and Design Arts Pathway.

**A2.1** Analyze the way in which technical design (e.g., color theory, lighting, graphics, typography, posters, sound, costumes, makeup) contributes to a performance or presentation.

**A2.2** Know the component steps and skills required to design, edit, and produce a production for audio, video, electronic, or printed presentation.

**A2.3** Use technology to create a variety of audio, visual, written, and electronic products and presentations.

**A2.8** Use models, simulations, and other tests to determine optimal design solutions from a variety of options.

# Bibliography

Curriculum Development and Supplemental Materials Commission. (2004). *Visual and performing arts framework for California public schools*. Sacramento, CA: California Department of Education.

DreamWorks. (2010). *The Production Process: How We Make Movies*. Retrieved February 7, 2010, from www.dreamworksanimation.com/.

Entertainment Economy Institute. (2005). *Crossworking: High-tech motion picture and television workers in California—Employment patterns and industry cross-over opportunities*. Los Angeles: California Community Colleges Economic and Workforce Development. Retrieved February 9, 2010, from www.entertainmentecon.org/File/Report/Crossworking.pdf.

Idleworm. (n.d.). *Animation tutorials*. Retrieved June 10, 2010, from www.idleworm.com/how/index.shtml.

Milnes, K., & Lee, K. (2006). *Multimedia Occupations: The Convergence of Art and Technology in the Age of New Media*. Los Angeles: The Entertainment Economy Institute. Retrieved February 9, 2010, from www.entertainmentecon.org/File/Report/Multimedia%20and%20Animation%20Report%20Final%206-29a.pdf.

Pixar. (2010). *How We Make a Movie: Pixar's Animation Process*. Retrieved February 8, 2010, from www.pixar.com/howwedoit/index.html#.

Public Affairs Coalition of the Alliance of Motion Picture and Television Producers, & PMR Group. (1997). *Making Digits Dance: Visual Effects and Animation Careers in the Entertainment Industry*. Los Angeles: City of Los Angeles Private Industry Council and NOVA Private Industry Council serving Silicon Valley. Retrieved February 10, 2010, from www.entertainmentecon.org/File/Report/MDD.pdf.

Skillset. (2007–2010). *Putting It Together: How Animation Gets Made*. Retrieved February 9, 2010, from www.skillset.org/animation/overview/article_3768_1.asp#Colouring.

Skillset. (2007–2010). *Skillset Careers: About the Animation Industry*. Retrieved February 9, 2010, from www.skillset.org/animation/overview/.

Skillset. (2007–2010). *Skillset Careers: Working in Animation*. Retrieved February 9, 2010, from www.skillset.org/animation/careers.

Taylor, T. A., & Parish, J. R. (2007). *Career opportunities in the Internet, video games, and multimedia*. New York: Checkmark Books.

Thomas, F., & Johnston, O. (1981). *The illusion of life*. New York: Disney Editions.

White, T. (2009). *How to make animated films*. Oxford: Focal Press.

Williams, R. (2009). *The animator's survival kit: Expanded edition*. London: Faber and Faber.