**Animation Lab**

**Constructing Physical Animations**

**Lesson Plan**

In this lab, students will use their understanding of foundational principles of animation gained from the development of a computer simulation in the Simulating Animation Lab to create a physical animation machine. This lab is based on a range of methods for creating physical animations that were developed in 18th and 19th centuries. Students will have the opportunity to create a design based on observation of these examples.

## **Big Idea**

In the Simulating Animation Lab, a digital strip of images was moved across the computer screen to create an animation. Each image was presented in a border known as a *frame* in a physical film strip. In cinema, the rate of presentation is specified in *frames per second*. In this lab, the digital strip will be transformed into a physical strip of images. This involves creating three elements: (1) a sequence of physical images that consist of the images used in the computer simulation, (2) a window that masks all the images except one comparable to the digital mask used in the computer simulation, and (3) a mechanism to control the rate at which the images are presented. This strategy was inspired by Edison’s Kinetoscope, which was first demonstrated in the 1890s. Students will emulate this method to design their own mechanism using the CAD program Onshape and fabrication tools such as scissors or a digital die cutter.

## **Purpose**

The purpose of this lab is for students to extend their knowledge of animation gain through the development of a digital simulation and create a parallel physical animation.

## **Required Knowledge/Skills**

Students should have basic mathematical computation skills that include addition, subtractions, multiplication, and division. Students should also have basic computer skills, an understanding of how animation works, and basic sketching skills in Onshape.

## **Lab Duration:**

4 hours

## **Learning Objectives**

The learning objectives for this lab are outlined below.

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| **BIG IDEA** | **LEARNING OBJECTIVES** |
| Computer simulations can be used to prototype physical systems in the real world. | * Students will construct a physical animation machine that utilizes the images created for the computer simulation in the previous lab. |
| Problems often have multiple solutions, and designers must consider the strengths and weaknesses of potential solutions. | * Students will observe that the process of invention and innovation involves frequent prototyping and iteration over a long period of time. |
| Animation relies on the idea of sequencing images, in which each image in an animation is shown in a certain order. | * Students will recognize that each image in an animation progresses in a linear order and that each image shows progression in movement. * Students will construct and design an animation strip that sequences their images in Onshape. |
| A mechanism that controls the amount of time an image is seen creates the illusion of continuous animated movement. | * Students will construct and design a simple viewing mechanism that allows for control over how long an image is displayed. |
| Frame rate is the speed at which images are displayed, measured in images per second. | * Students will observe that we perceive images being displayed at higher frame rates as continuous animated motion, and we perceive images being displayed at lower frame rates as individual images. * Students will explain how frame rate affects how we view a set of images on an animation strip. |

## **Lab/Classroom Prep**

### **Teacher Preparation:**

### The classroom or laboratory must provide a learning environment that provides for lecture and demonstration, small-group meetings, and research activities.

### **Required Tools/Materials/Equipment:**

### Below are supplies and equipment needed to teach this course, assuming a class of 25 students. Optional/additional supplies required for Enrichment Activities are indicated. Where possible and appropriate, merchants are listed that support ITEEA; however, materials may often be obtained from alternative and/or local sources. Additionally, these materials are based upon the lessons in the course and make no assumptions for classrooms with access to specialized equipment (e.g., fabrication equipment). If the student has access to specialized equipment, the teacher may wish to incorporate the use of it into the lessons, and additional supplies may be necessary (as well as safety procedures).

**Necessary for Activity**

* Computer
  + Mac, Windows, or Chromebook recommended
  + iOS or Android device supported
* Onshape Educational Account
  + Onshape Educational Enterprise Account recommended.
  + [Link](https://www.onshape.com/en/)
* Other CAD Software
  + If not using Onshape, Silhouette Studio or Cricut Design Space are options.
  + Silhouette Studio: [Link](https://www.silhouetteamerica.com/software)
  + Cricut Design Space: [Link](https://design.cricut.com/#/)
  + Cricut Design Space - Google Chromebook Application: [Link](https://play.google.com/store/apps/details?id=com.cricut.designspace&hl=en_US&gl=US)
* Printer
  + A printer for printing student animation strips created in Onshape is recommended.
* Die Cutter (Silhouette Portrait, Cricut, etc. and their associated software)
  + A die cutter for cutting and constructing student designs is recommended but not required.

### **Lab/Classroom Safety and Conduct:**

* Note: Safety is of paramount importance to every classroom. While this Guide contains some general safety guidelines, it does not address the specific tools, equipment, and working spaces found in any specific classroom. Teachers must provide comprehensive safety guidelines to students based upon individual classrooms.
* Students use tools and equipment safely, maintaining a safety level for themselves and others in the laboratory-classroom.
* Students demonstrate respect and courtesy for the ideas expressed by others in the class.
* Students show respect and appreciation for the efforts of others.

### **Sequence of Activities**

|  |  |  |
| --- | --- | --- |
| **Instructional Materials** | **Description** | **Duration** |
| **Overview Document:** | This document provides background and historical perspective a general overview of what will be created by the student. This can be reviewed by both teachers and/or students. | 10 minutes |
| **Video:**  [The Kinetoscope](https://www.youtube.com/watch?v=sfI0NVC0hLU) | The instructor will introduce students to the principles of physical animation using the video *The Kinetoscope*. This video illustrates and explains how a Kinetoscope works and presents one method of controlling the amount of time an image is seen.  After viewing the video, the instructor should ask students how the Kinetoscope is similar and different to their computer simulations they created in Simulating animation lab.  The instructor should also be analyzing student responses to the video to gauge student readiness for the rest of the lesson. | 5 minutes |
| **Video:**  Designing a Physical Animation Strip  **Activity Instructions:**  Designing a Physical Animation Strip | The teacher will show students the *Designing a Physical Animation Strip* video, which details how to arrange a sequence of images on a strip of paper using a template.  The *Designing a Physical Animation Strip* activity instructions parallel the video and will guide students through the design process.  The instructor should be sure to highlight how the succession of slight changes from one image to another is the most basic part of an animation. | 30 minutes |
| **Video:**  Designing an Animation Disk  **Activity Instructions:**  Designing an Animation Disk  **Template:**  Animation Strip Template | The teacher will show students the *Designing an Animation Disk* video, which details how to design a mechanism that will simulate the function of a shutter in the physical animation machine.  Students will use CAD software to design a shutter out of card stock and then cut it out using either a cutting machine or a pair of scissors. | 40 minutes |
| **Video:**  Physical Animation Machine Assembly  **Activity Instructions:**  Physical Animation Machine Assembly  **Computer-Aided Design (CAD) Files:**  CAD Files | Students will watch the *Physical Animation Machine Assembly* video, which demonstrates how to fabricate and assemble the remaining pieces of the animation machine.  Activity instructions parallel the video and will guide students through the assembly process.  Completed computer-aided design files should be provided to the students.  Materials can be cut from cardstock using either a cutting machine or a pair of scissors. | 30 minutes |
| **Activity Resources:**  Jointed Toy Patterns | Students needing an enrichment activity can make additional animation strips using the *Jointed Toy Patterns* book or draw animation frames of their own. | 20 minutes |