



**CNM 190**  
**Advanced Digital Animation**  
Dan Garcia, EECS (co-instructor)  
Greg Niemeyer, Art (co-instructor)  
Jeremy Huddleston, EECS (TA)  
Randy Nelson, Pixar (today's guest lecturer)



## Today's Overview

- **Greg**
  - Welcome, Class mission
- **Randy**
  - Pixar production pipeline
- **Dan**
  - Technical challenges (read: projects)
  - Expectations
  - Examples of great animations (if time)

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## Pixar Production Pipeline

Randy Nelson  
Dean, Pixar University

## Story-driven process

- **The Pixar filmmaking process is story-driven**
  - We use traditional skills like storytelling, drawing, painting and sculpture
    - This allows the work to be easily shared, keeps it informal and encourages experimentation
  - Technology serves the needs of the story
    - Story determines what to put in the film and technology responds

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## World, Character, Story

- **The story process is moved forward by designs for the world & characters of the film**
  - The world has its own rules, that limit what the characters can do
    - Building unique worlds is at the heart of animation
  - The characters have things they want and need, that push the limits of the world
    - Characters should feel like they live beyond the frame of the film

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## Design

- **Everything is design**
  - We alternate cycles of planning and implementation
    - We avoid 'waterfall design' where all design is complete before implementation begins
  - We don't do any manufacturing
    - That happens at Technicolor after the finished print leaves our building

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## Timeline & Departments

- A four year design process
  - Planning — all four years
    - Story, Art, Editorial
  - Implementation — the last two years
    - Editorial
    - Modeling, Articulation, Shading, Digital Paint
    - Layout, Set Dressing, Animation, Lighting
    - Rendering

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## Story, Art & Editorial

- Three departments are the focus of design
  - Story creates storyboards
    - Drawings that are a comic strip version of the film's important moments
  - Art creates inspirational images, character and set designs, colorscripts and lighting pastels
    - Refined images that establish the look and feel of the film
  - Editorial creates story reels
    - A rough draft form of the film made using the storyboard drawings, scratch dialog and borrowed music
- The goal of the planning process is a solid story reel

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## Objects & Shots

- The implementation of the film is split between making objects and using those objects to make shots
  - Everything in the film, every character, prop and location, must be created first
    - Nothing is free; if it is in the film, it must be imagined and built
  - Shots are created by populating each scene in the story with the correct objects
    - Only once the cast is on the set with their props can we begin the visual storytelling

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## Objects

- The shape and surface are created separately for every object
  - Modeling and Articulation deals with shape and how the shape moves
    - These are primarily 3D skills
  - Shading and Painting works on surface
    - These are primarily 2D skills

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## Modeling & Articulation

- Modeling & Articulation deal with the shape of the objects, and how they can be moved
  - Modeling is like sculpture, inside the computer — it creates the static shape of the object
    - The model does not bend
  - Articulation or rigging provides the 'hinges' in the model that allow it to be positioned
    - The rigged model can be posed, and in the hands of an animator, can act
    - Props and sets get less articulation than characters

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## Shading & Painting

- Shading and painting deal with the surface color and texture of the object
  - A procedural shader is a computer program that represents how light interacts with a surface
    - Shaders can provide surface deformation as well as color — they can make a smooth model look bumpy
  - Digital painting allows textures or other paint marks to be applied directly to surfaces
    - Once a surface has been shaded, digital paint can be used to rough it up or add other naturalistic details

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## Shots

- **Objects are assembled into shots**
  - Layout sets up the basic blocking for character and camera movement
    - Layout is informed by the storyboards and story reel
  - Set Dressing makes sure each shot is well framed by the set and props
    - Dressing may also build the set used by Layout
  - Animation moves each object
    - Animation provides the acting in 24ths of a second
  - Lighting lights the shot to focus the action and to help create the mood
    - Lighting is directed by images created by Art

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## Animation

- **Animation means to bring to life**
  - Animation uses the hinges in the object's rig — avars or articulated variables — to change the its location & position over time
    - Animators are actors who can break down a performance into poses
    - Each pose attempts to capture the essence of the character's thoughts and feelings

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## Rendering

- **Rendering is the final step in the implementation pipeline**
  - Rendering is like taking a digital picture of the world inside the computer
    - The renderer produces a 2D image of the 3D scene in the computer
    - A film consists of 120,000 or more rendered 2D images, each onscreen for a 24th of a second

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