
2D & 3D Animation

NBAY 6120

Lecture 9

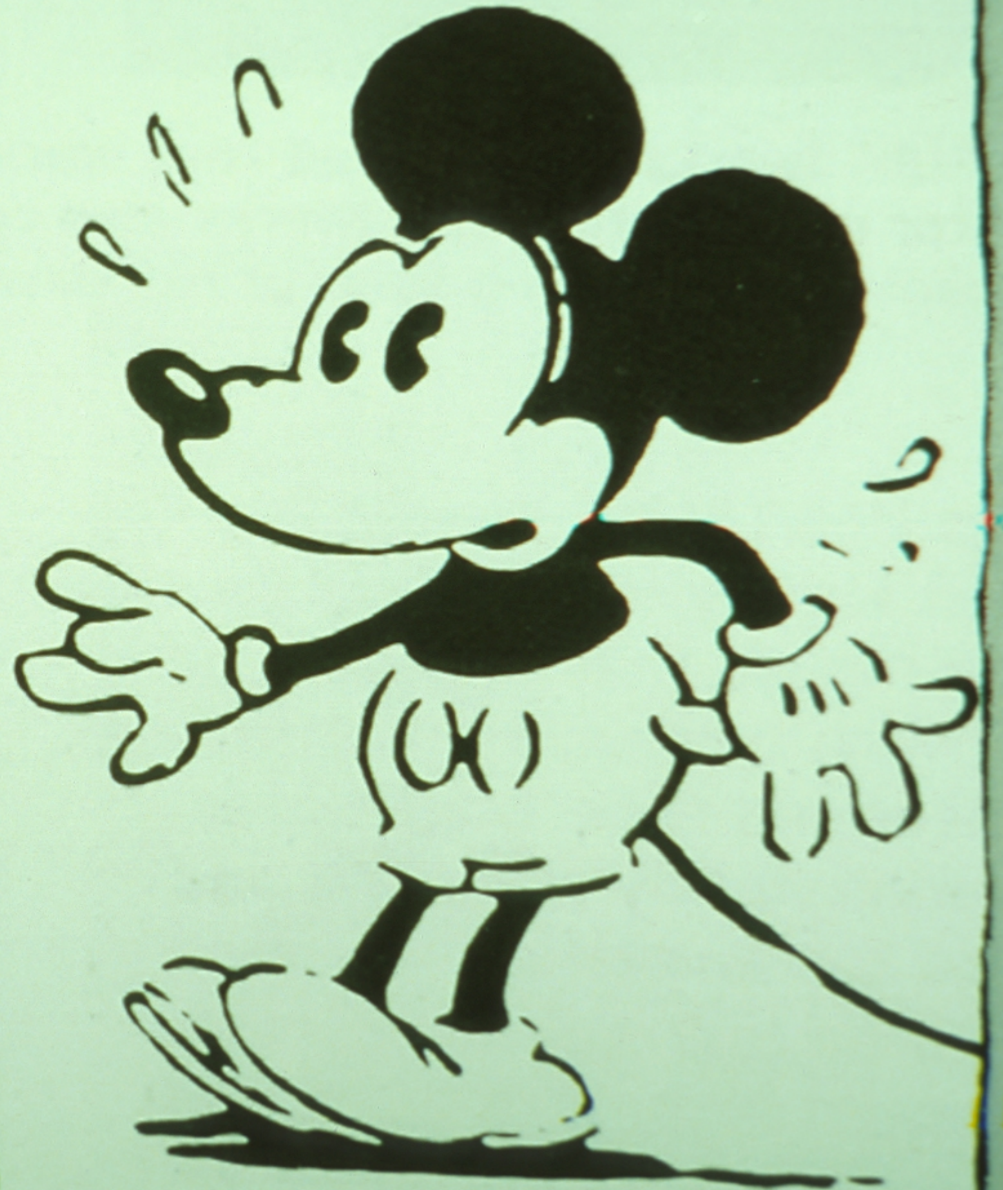
Donald P. Greenberg

March 27, 2018

2D Cel Animation

Mr. Walt Disney





Snow White
And The Seven Dwarfs



the
DISNEY VAULT
www.thedisneyvault.webs.com



William Hannah



Joseph Barbera

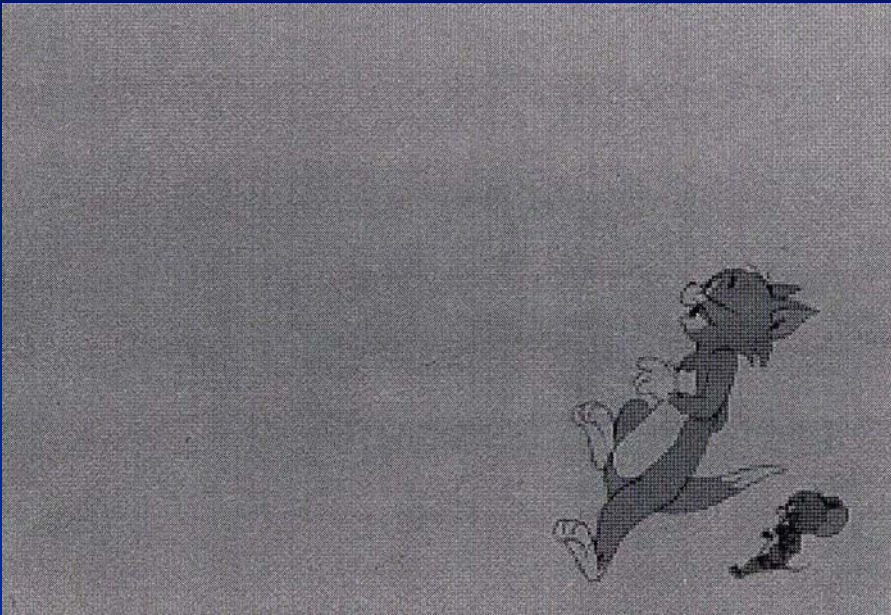
Cartoon Animation

- **What is cartoon animation?**
 - A sequence of drawings which, when viewed in rapid succession, create an illusion of continuous life-like movement.
- **Cel animation**
 - Process in which background and action are drawn separately
 - Background and action are placed together when ready to film

Steps for creating cel-animated films

- ✓ Background is drawn and colored
- ✓ Key animator draws the most important, or key, frames of character
- ✓ In-betweeners draw the intermediate frames with all the action required of the character
- ✓ Cels are inked and painted
- ✓ Checker places each cel on the background and checks the quality of art and movement
- ✓ Each cel is filmed

Cel-animation

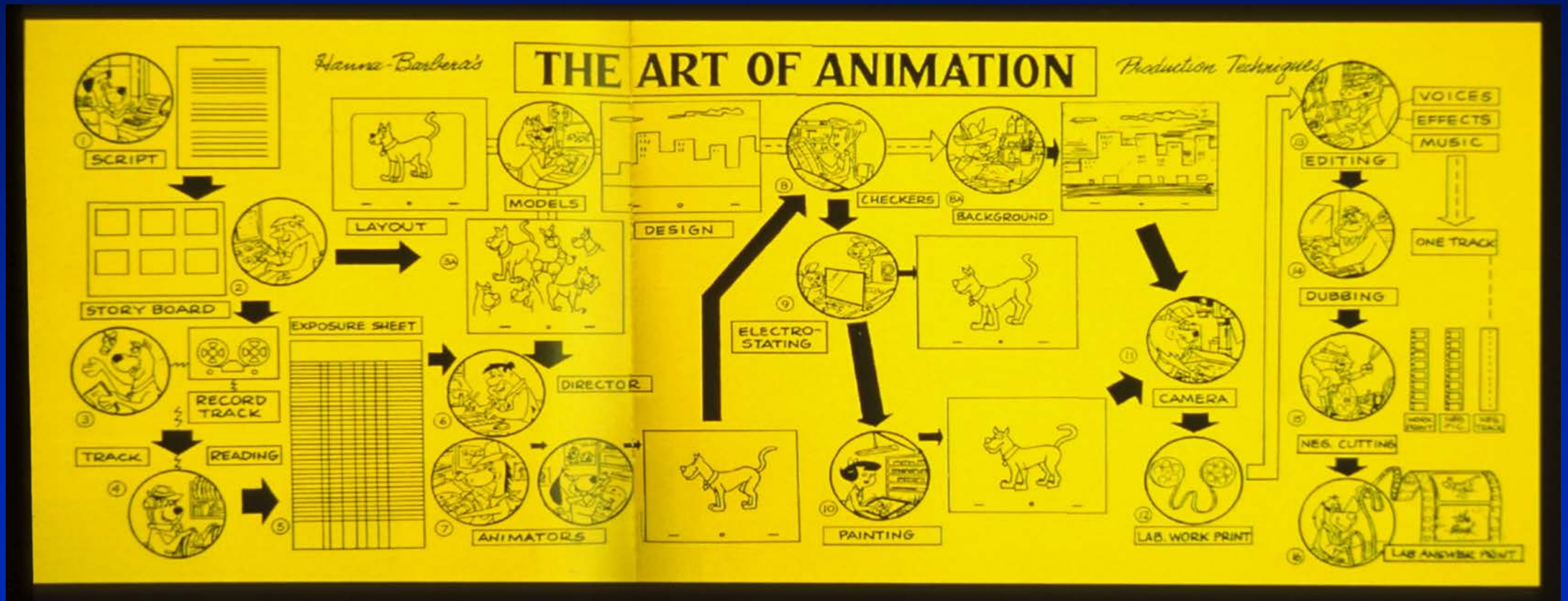


Standard Animation Cel



Standard Animation Cel
With Background

Cel-animation

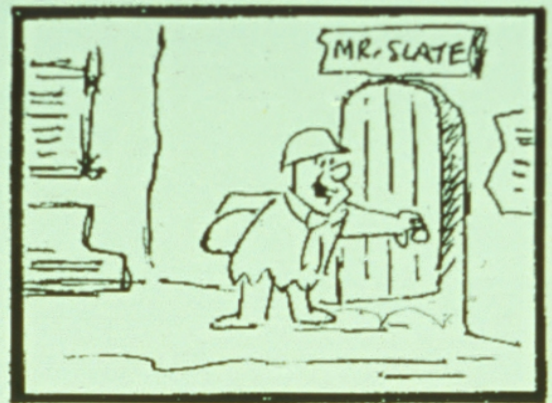


SONG
"MY FAVORITE
TIME OF THE YEAR"
PROD. # 110-1

FOLIOS SC. #110
P. - 35

REVISED
10/13/77

SC.
(111)



FRED: MERRY CHRISTMAS,
MISTER SLATE!



(FX: DOOR SLAM!)

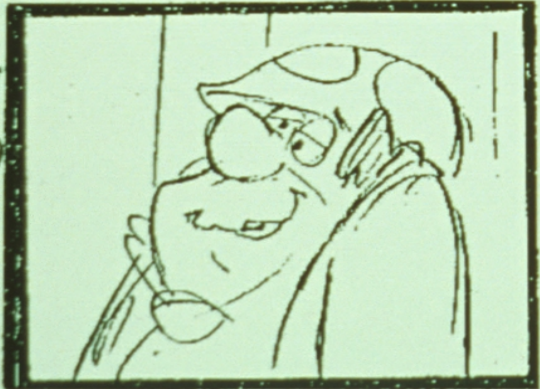
OCT 21 1977

PAGE 1
(1)

L.O. CHECK BB'S AROUND SC. #86
FOR CONSISTENCY

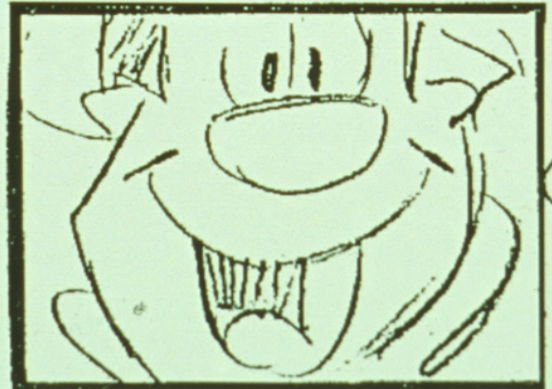
FINAL PRODUCTION BOARD

CUT
~~(111)~~
(111A)

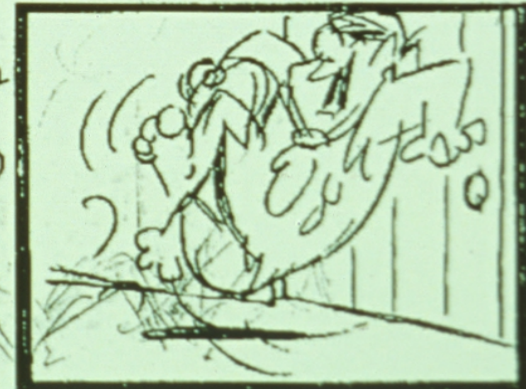


(FRED SAGS)
FRED: (RELIEVED) WHHEW!

CUT
~~(111)~~
(111B)



(INTO HAPPY REALIZATION)
OH BOY! OH BOY! OH BOY! OH BOY!

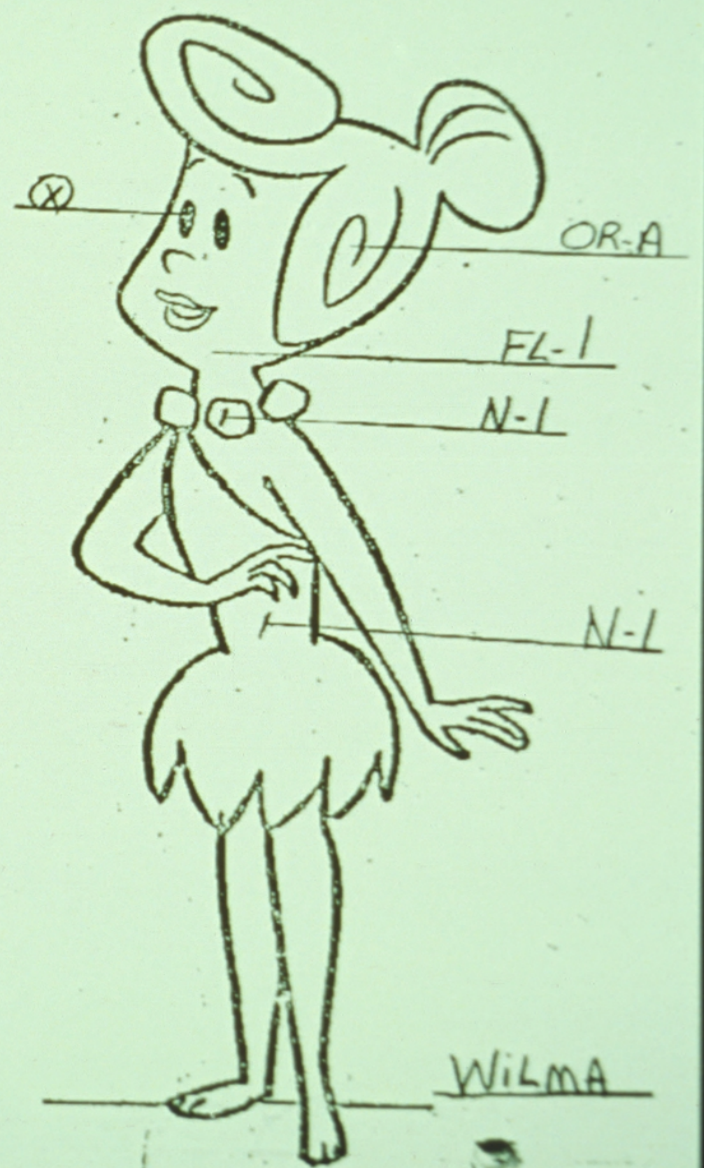
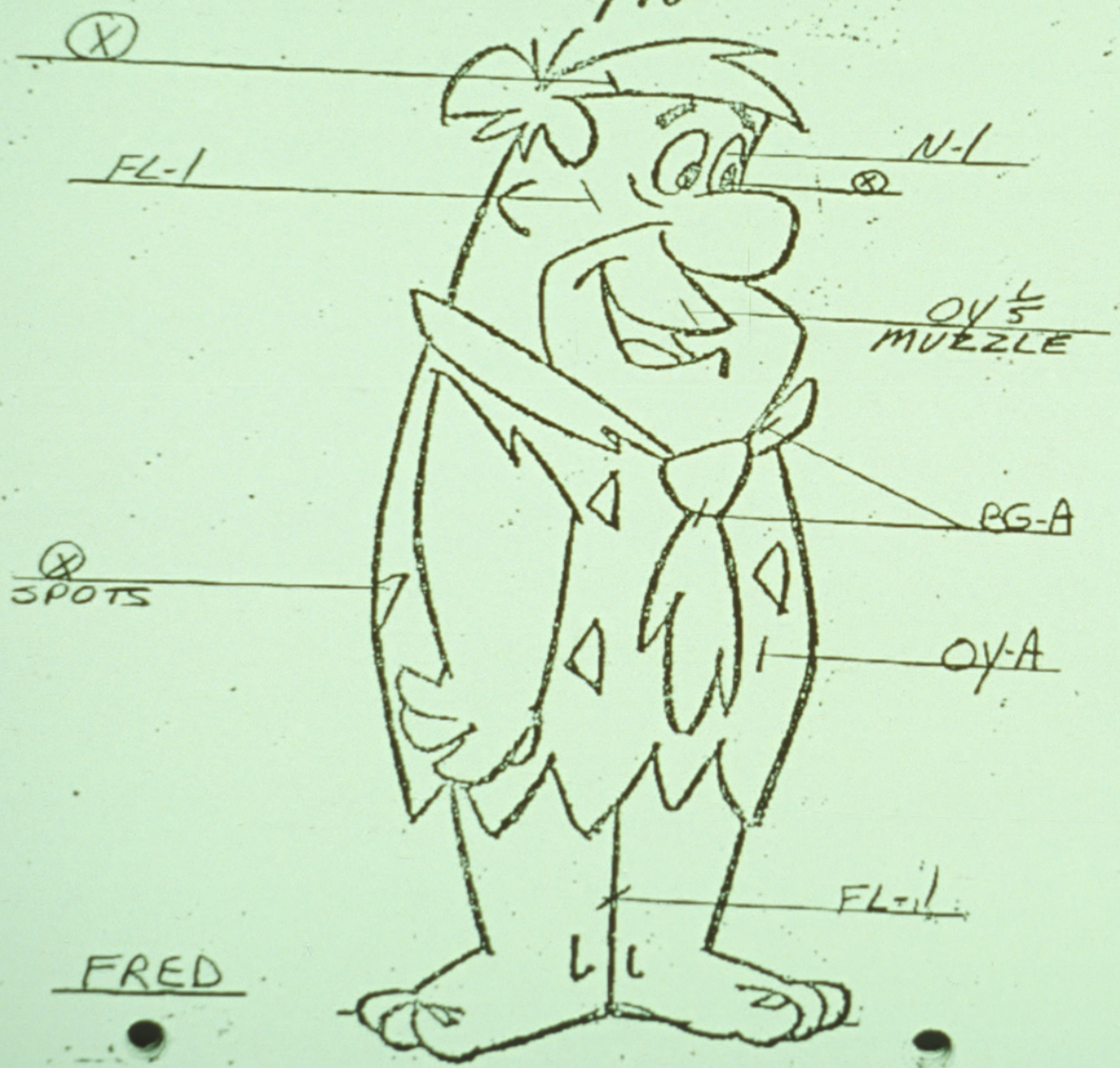


FRED: YABBA DABBA
DOO ~~~~~!

154 SERIES THE FLINTSTONES

Hanna-Barbera Productions, Inc.

11/78





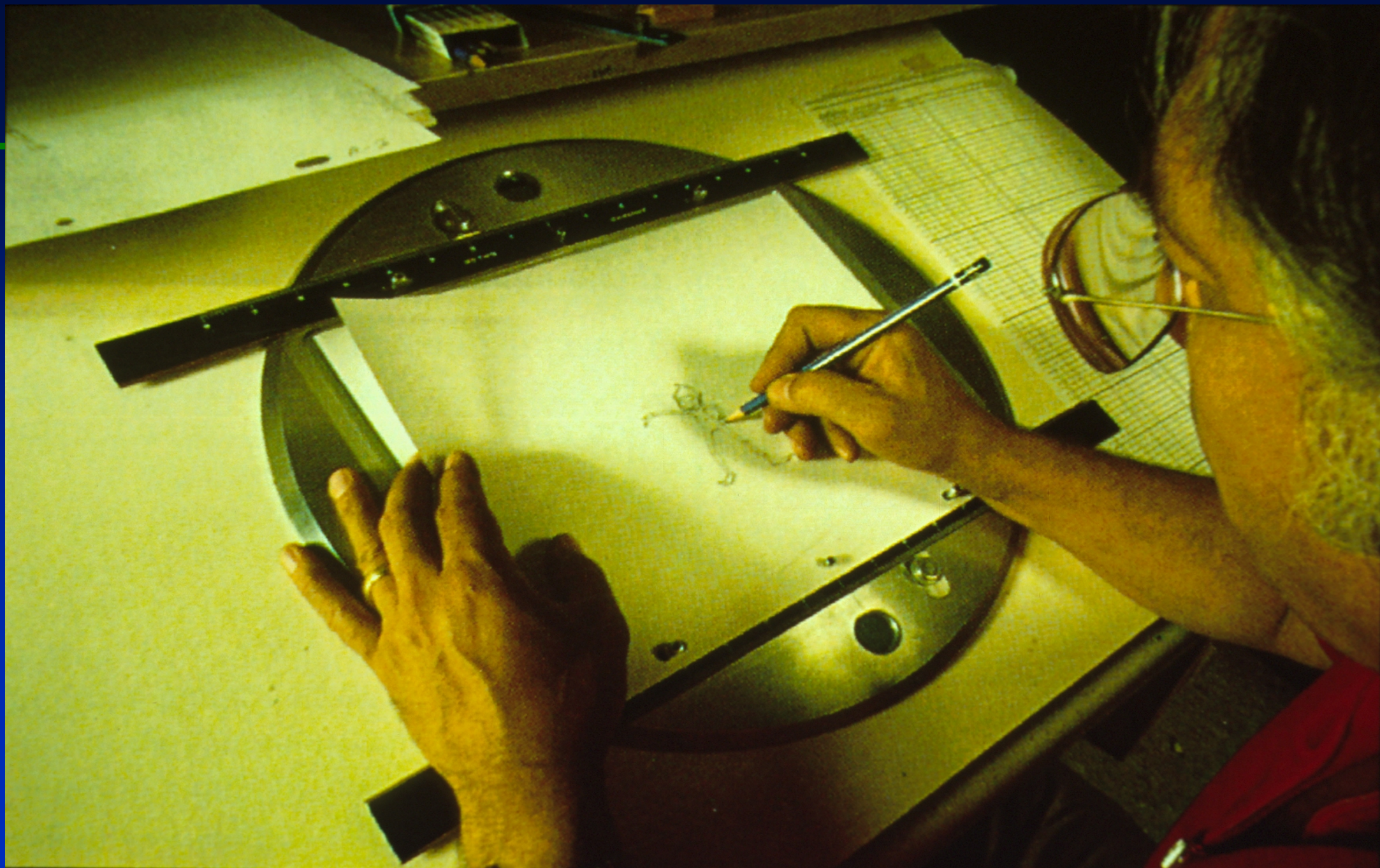
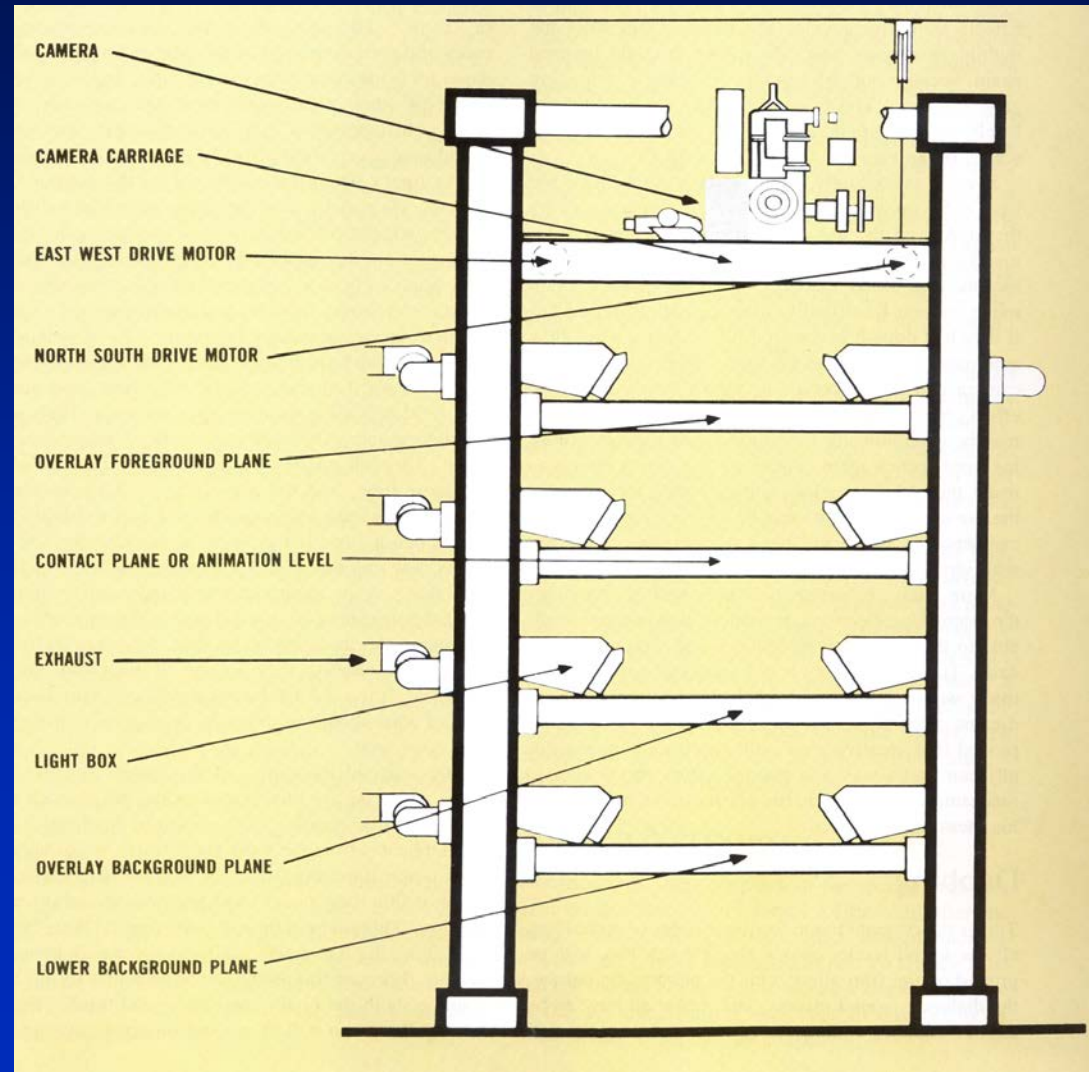




Figure 2a: Walt Disney's multiplane camera stand

Multi-Plane Camera



Automating the production process with computers for keyframe animation

- **Almost the entire process of creating an animated film can be automated with a computer**
 - Backgrounds can be drawn and colored on a computer
 - Key frames should still be drawn by key animator
 - In-between frames can be interpolated with a computer
 - Cels can be inked and painted on a computer
 - Cel and background can be put together and checked with a computer and then filmed

Approximate Employee Distribution, 1975

• Storyboard/Screen Writers	5
• Background	10
• Animators (140)	
– Key	25
– Ass't	40
– In-betweeners	75
• Checkers	10
• Inking/Painting	220
• Sound/Music	5
• Editing	10
	<hr/>
Total	400

Automating the production process with computers for keyframe animation

- Backgrounds can be drawn and colored on a computer
- **Key frames are still drawn by key animator**
- **All in-between frames are still drawn by animators**
- Cels can be inked and painted on a computer
- Cel and background can be put together and checked with a computer and then filmed

Advantages of Partial Animation

- All artistic control stays with the animators
- The cost of the most expensive part of the production process (inking and painting) is vastly reduced (1/10th)
- Can still take advantage of special features
 - > Zooming
 - > Color changes
 - > Multi-Plane camera simulation
 - > Reduction in scale





Three-Dimensional Computer Animation

Why do we need an animation production pipeline?

- Animated full-length features are huge endeavors
 - Up to 5 years from conception to final (2 years in production)
 - > 500 people involved
 - Currently requires big budgets and big organizations
 - \$ 100 M - \$150M per movie
 - Needs a very organized structure to bring the creative process from conception to final product

Toy Story 3

Building a Single Frame



1 / SKETCHES There are 49,516 of these sketches in the movie's story reel.

Building a Single Frame



2 / COLOR SCRIPTS The goal is to begin to define the style and lighting scheme of the frame.

Building a Single Frame

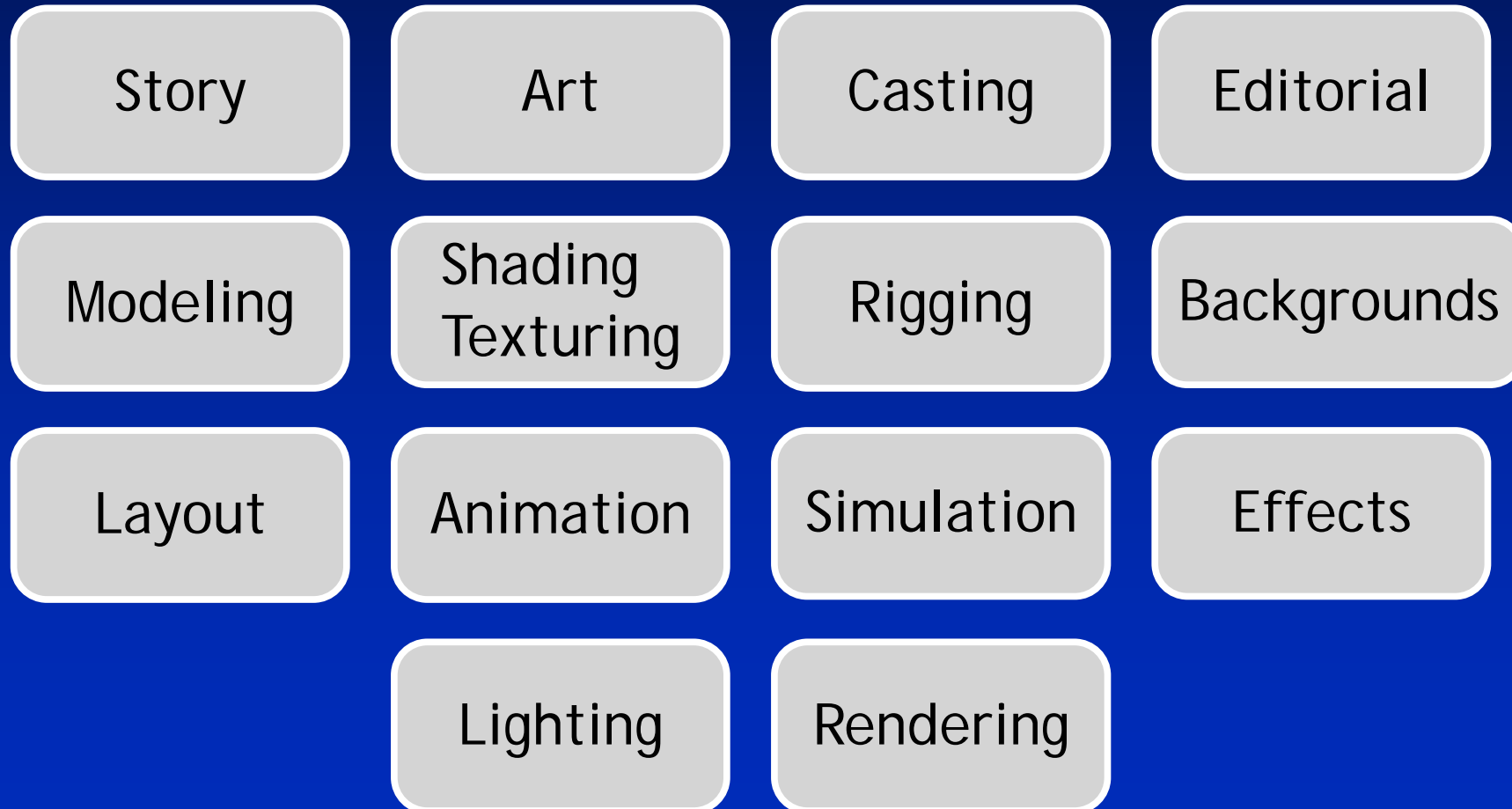


3 / PROPS Toys are positioned in the 3-D “dressed set.” The director can fine-tune the camera’s movement to best capture the action.



The simplified pipeline

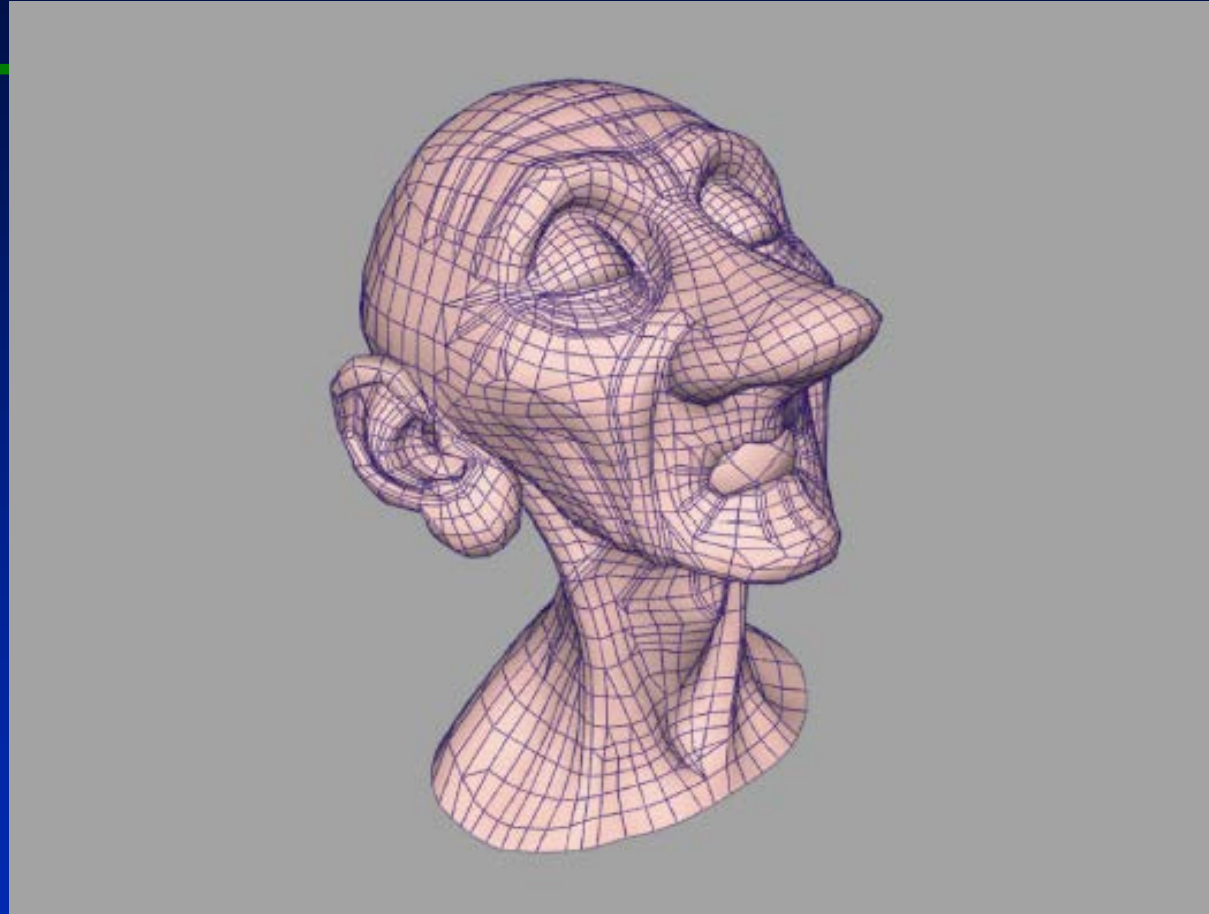
- Many departments



Jan Pinkava – *Storyboard*

GERI'S GAME (Pencil)





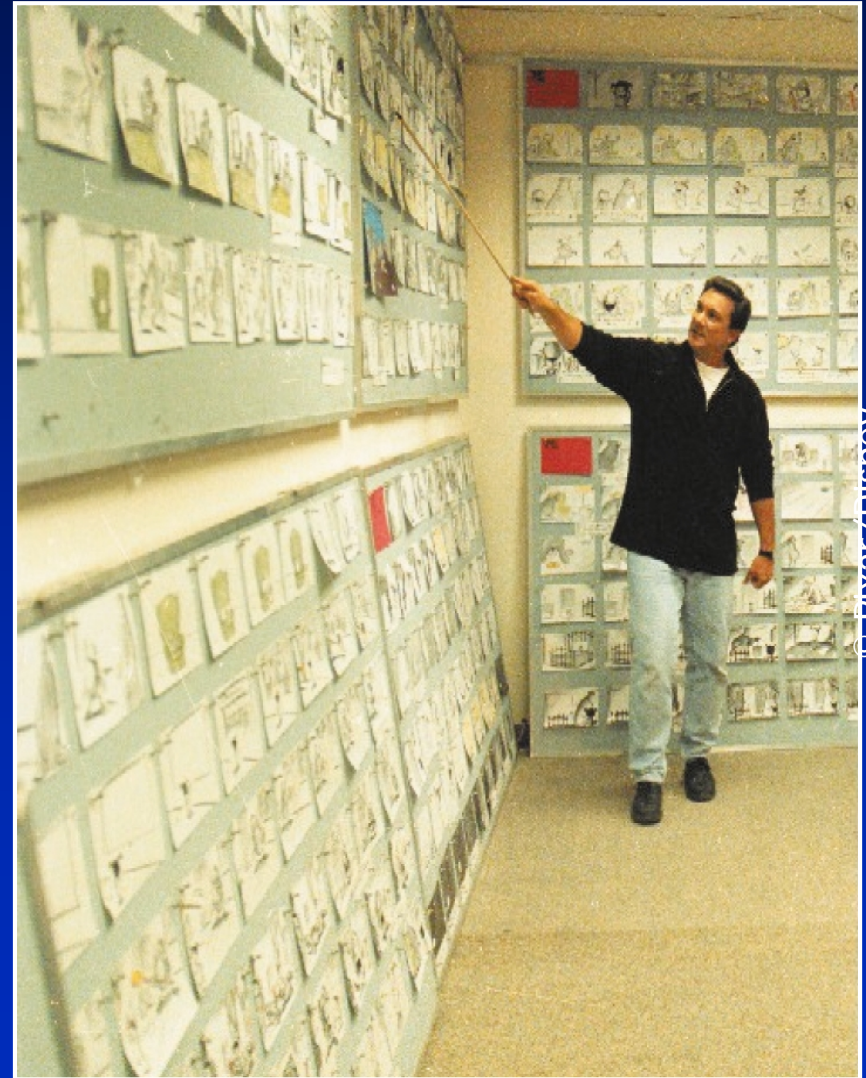
The control mesh for Geri's head, created by digitizing a full-scale model sculpted out of clay.

Subdivision surfaces



© Pixar/Disney

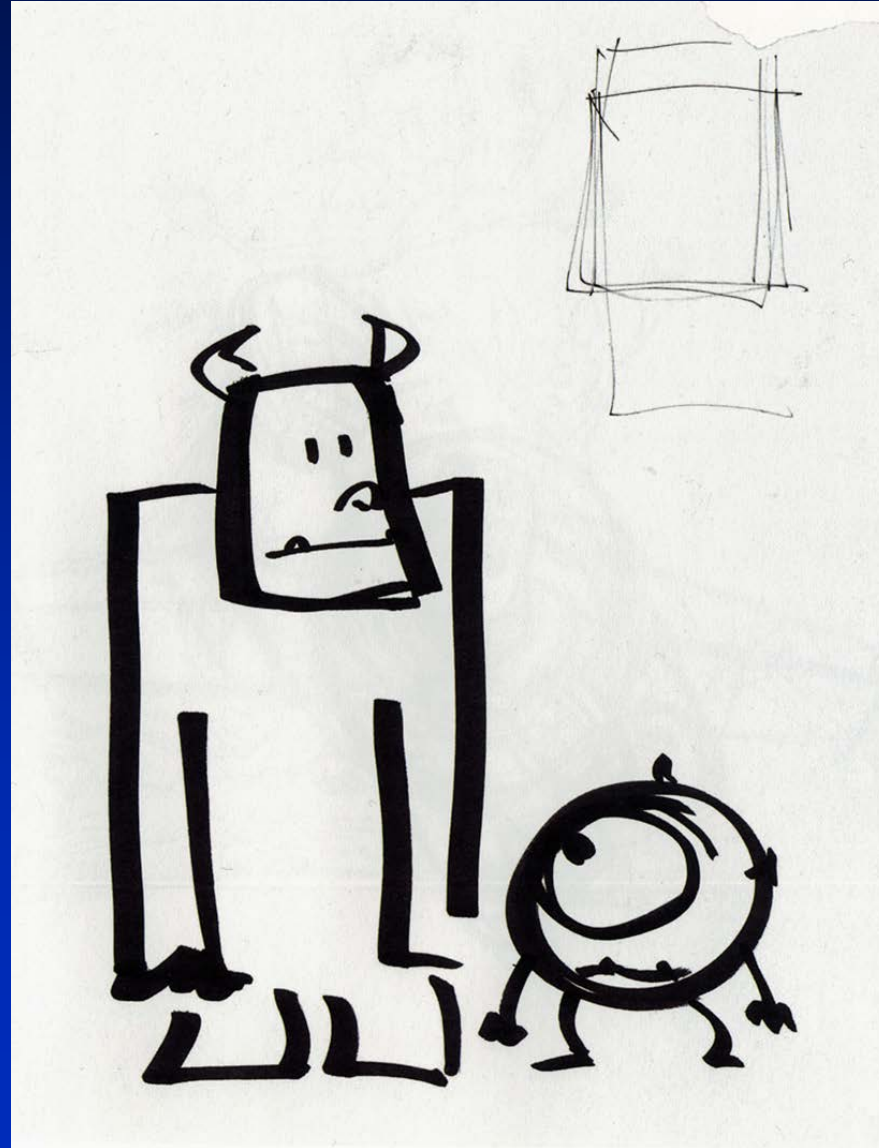
Story Development



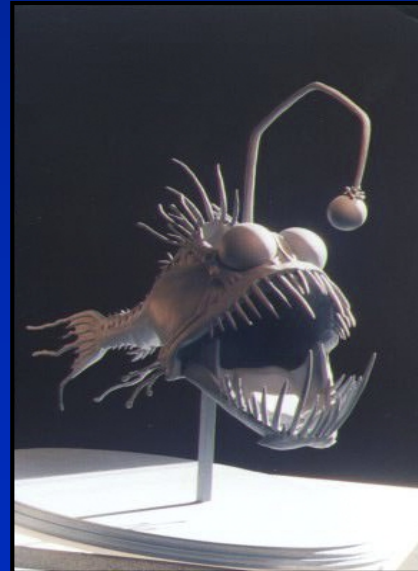
Art Development

- Develop the look-and-feel of the movie
 - Characters and Sets
 - Follow it through production
 - Make the most of the *high-level* artistic decisions
- Traditional media
 - Sketches, Pastels, Sculptures
- Process
 - Start with real world objects
 - Develop the look: shape, colors, materials
 - Develop expressions and movements
 - For characters, sculptures are developed

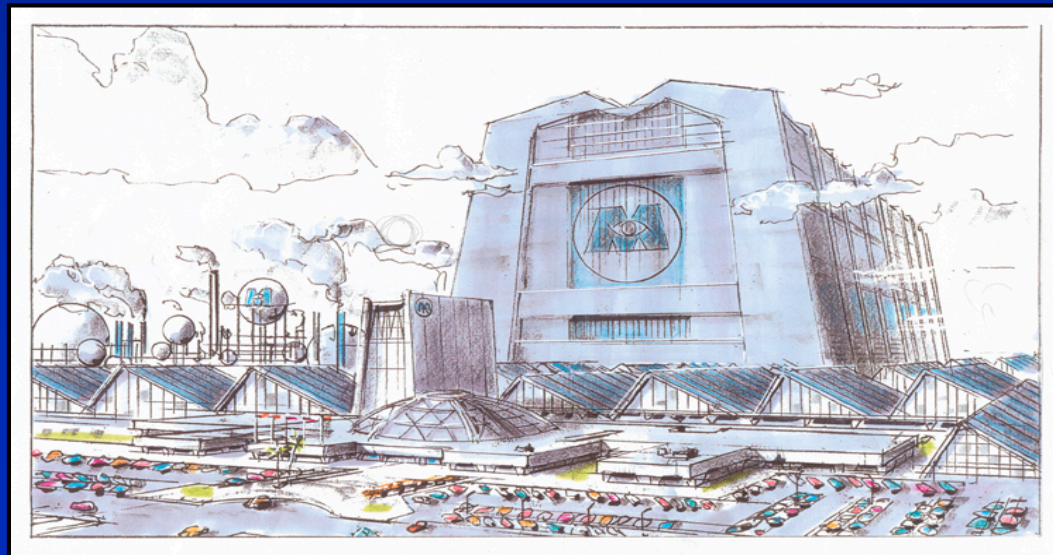
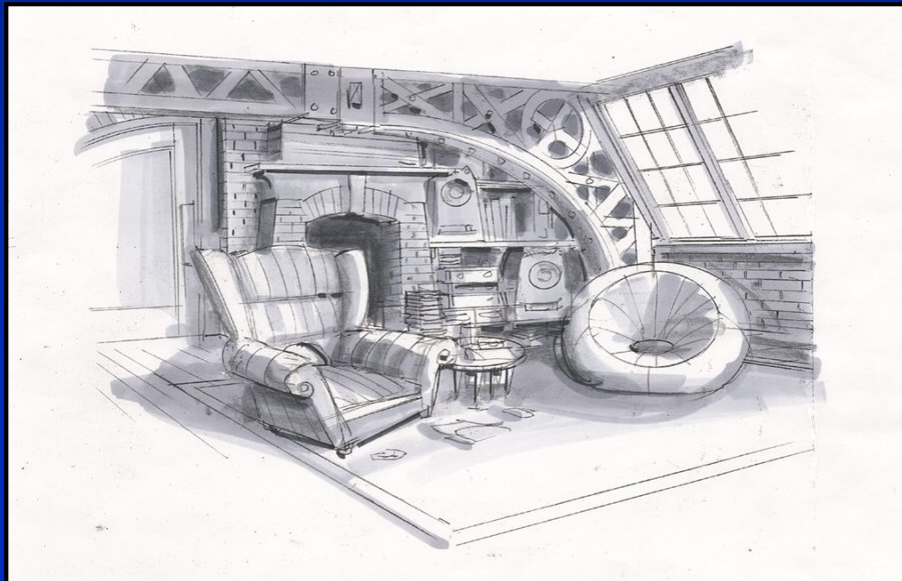
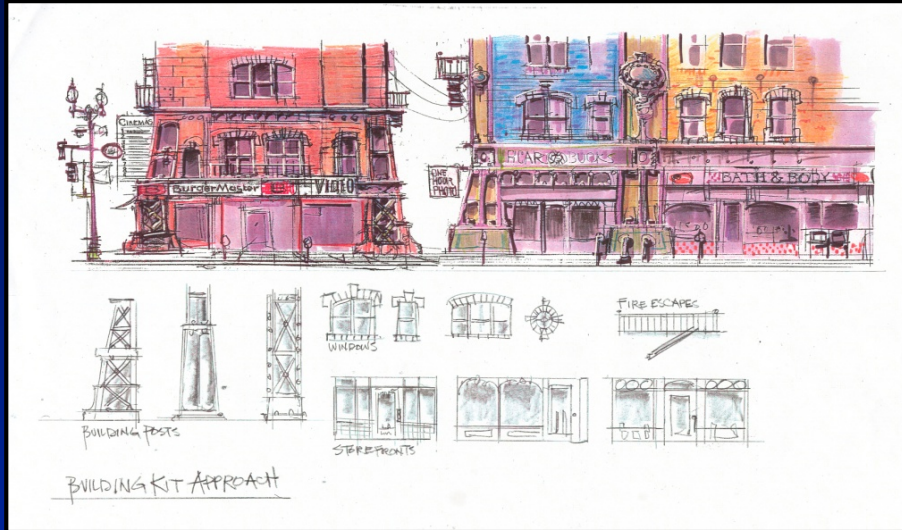
Pete Docter – Sullivan and Mike (Marker)



Art Development - Characters

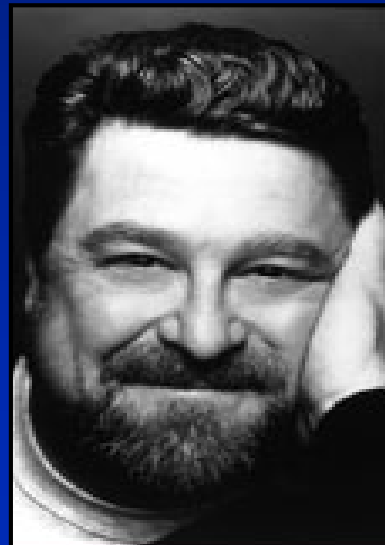


Art Development - Environments

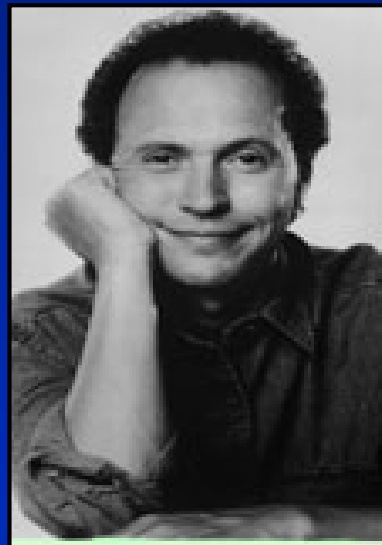


Casting

- Voices have to match your characters



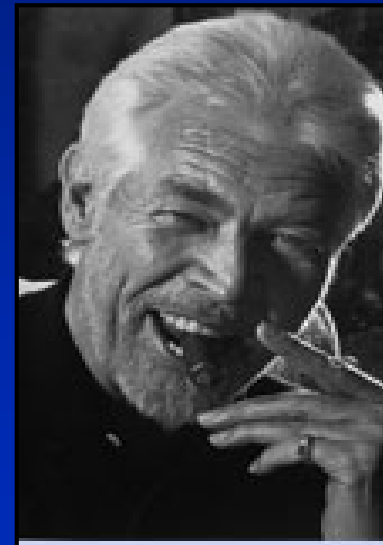
JOHN GOODMAN



BILLY CRYSTAL



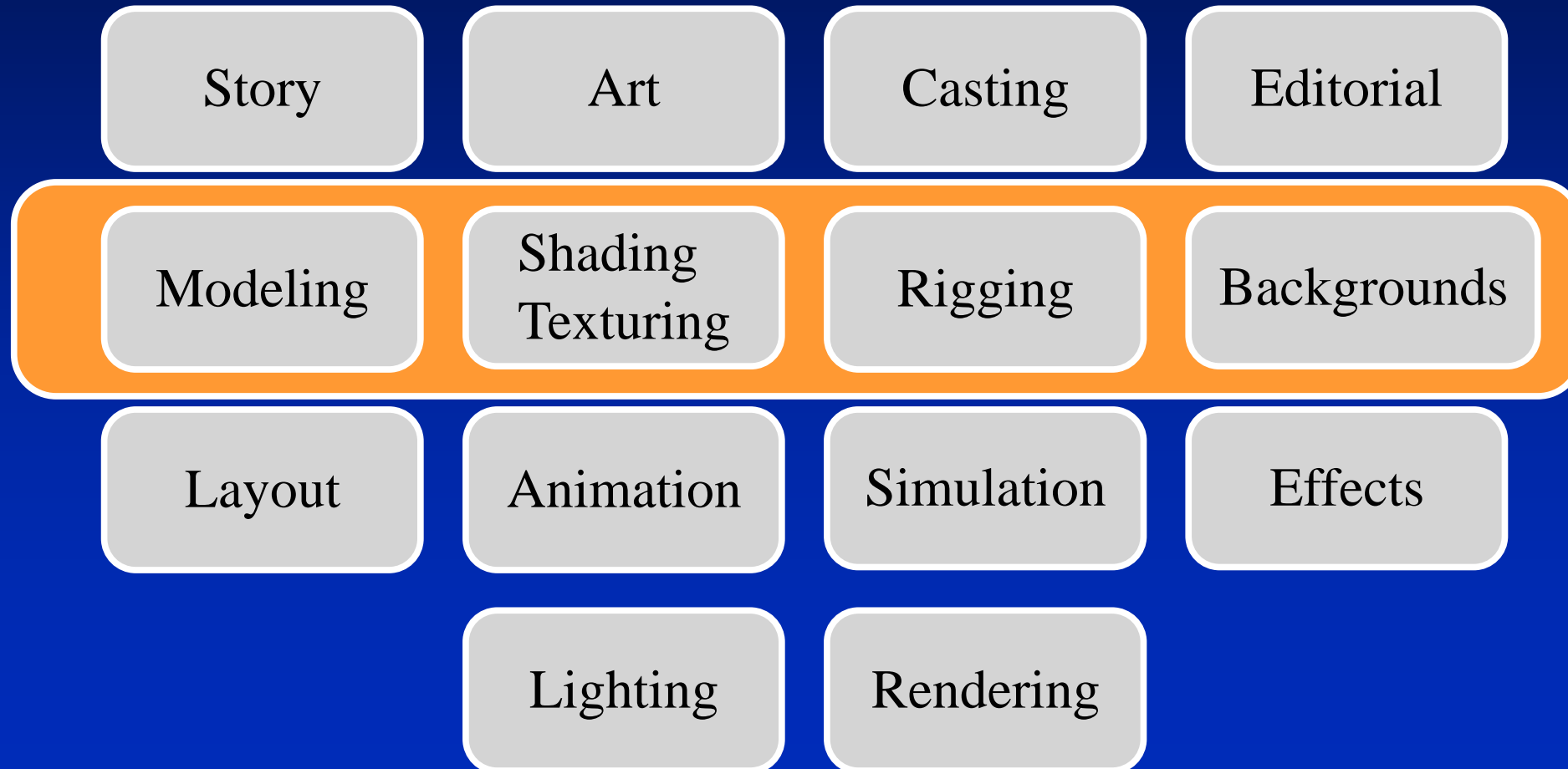
STEVE BUSCEMI



JAMES COBURN

The Simplified Pipeline

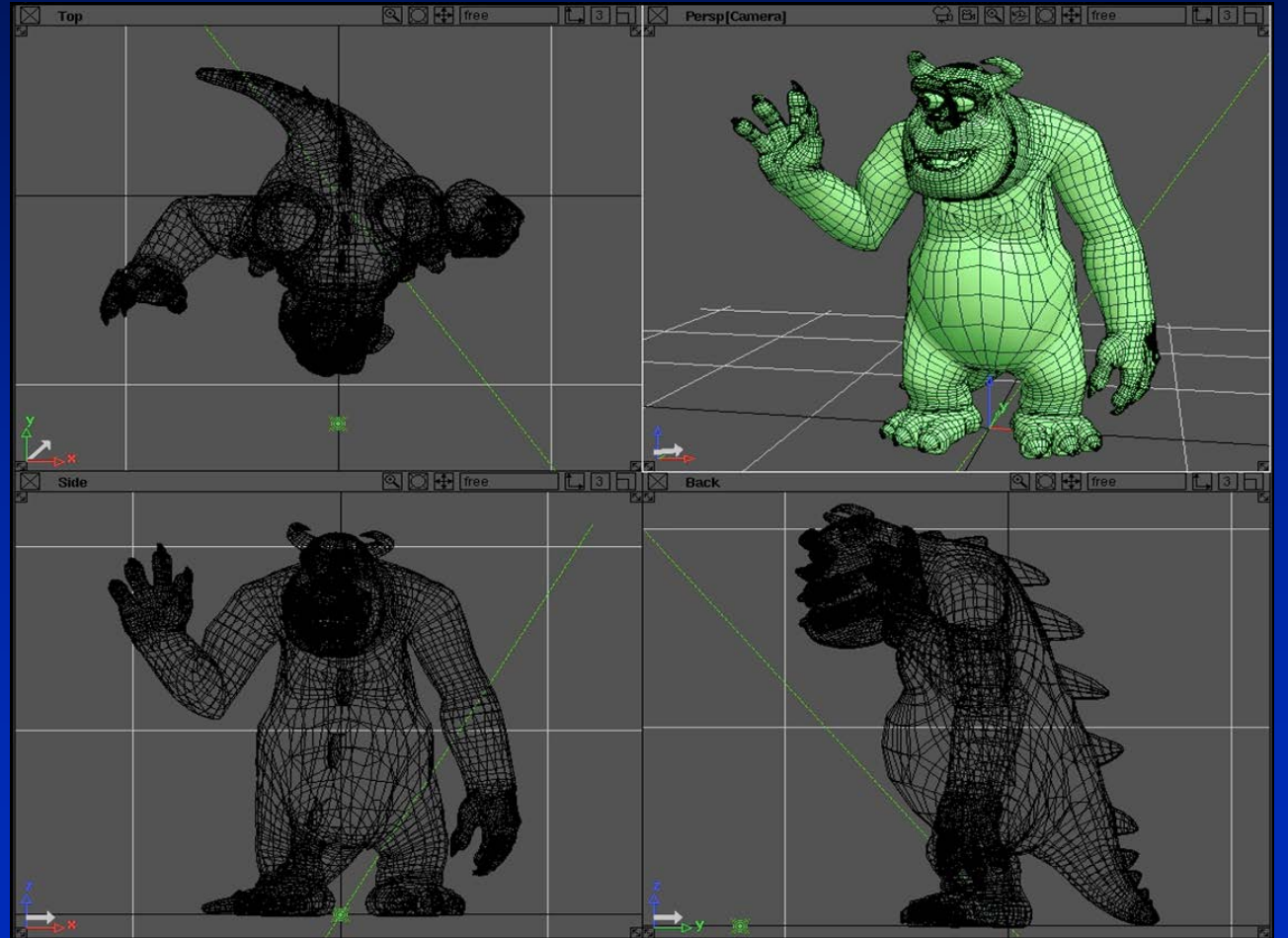
- Characters and Sets



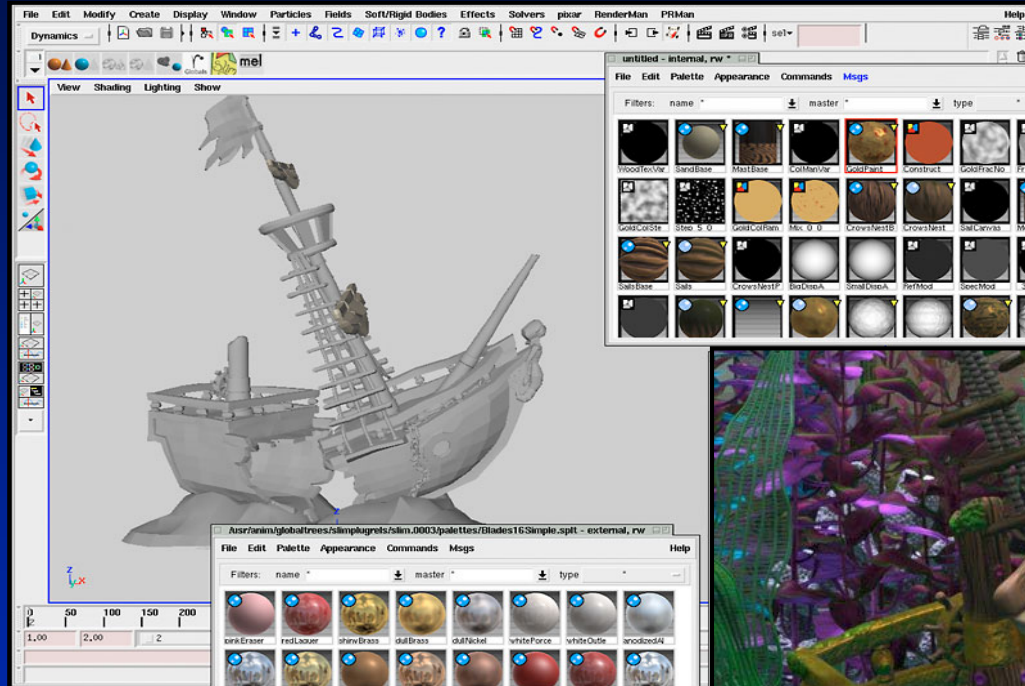
Modeling

- Defines the shape
- Process
 - Starts with art data
 - > Drawings
 - > Sculptures (sometimes scanned)
 - Recreate geometry in the modeling environment
- Models have to
 - Look good – to please the eye
 - Be functional – to fit in the pipeline
 - Work when deformed – for animation

Character Modeling



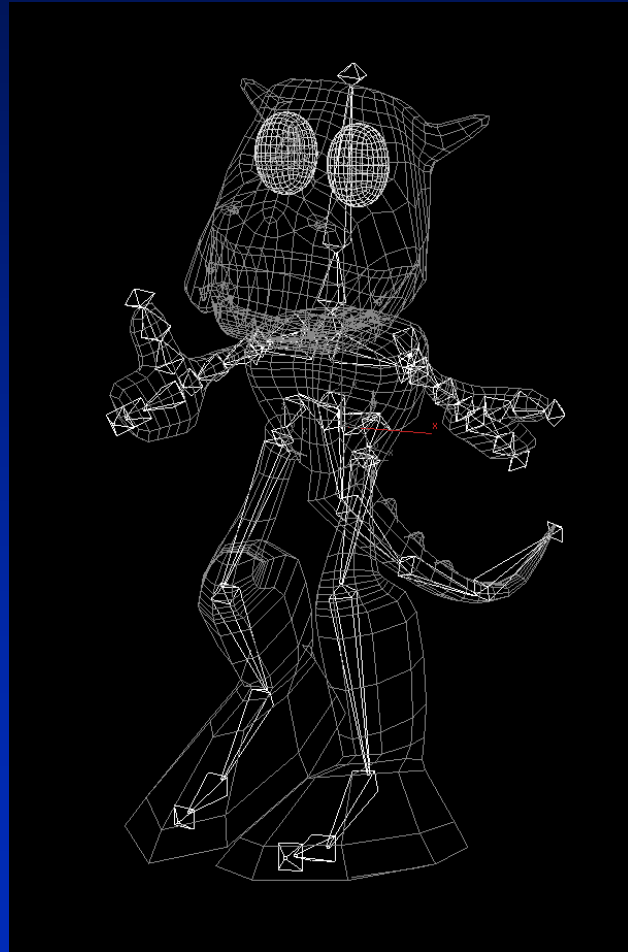
Shading



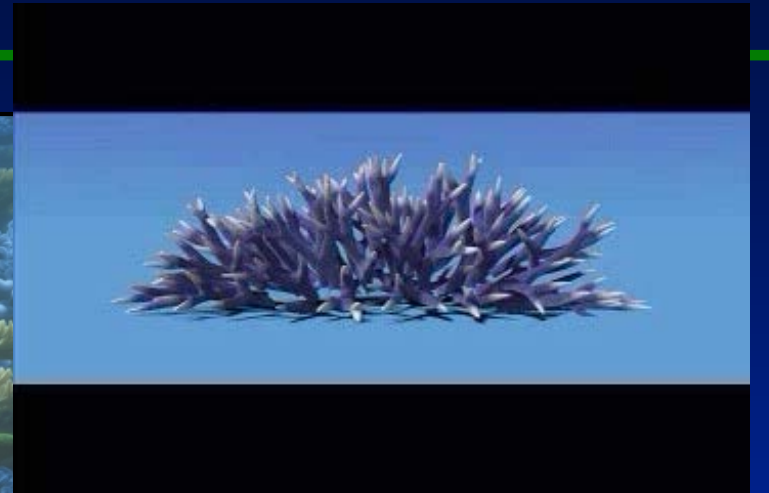
Character Rigging

- Prepares a character for animation
 - Defines the deformation of the shape
 - > Shape changes when the character moves
 - Defines controls for animators
- Process
 - Start with art data
 - Work with animation to test the look and controls

Rigging

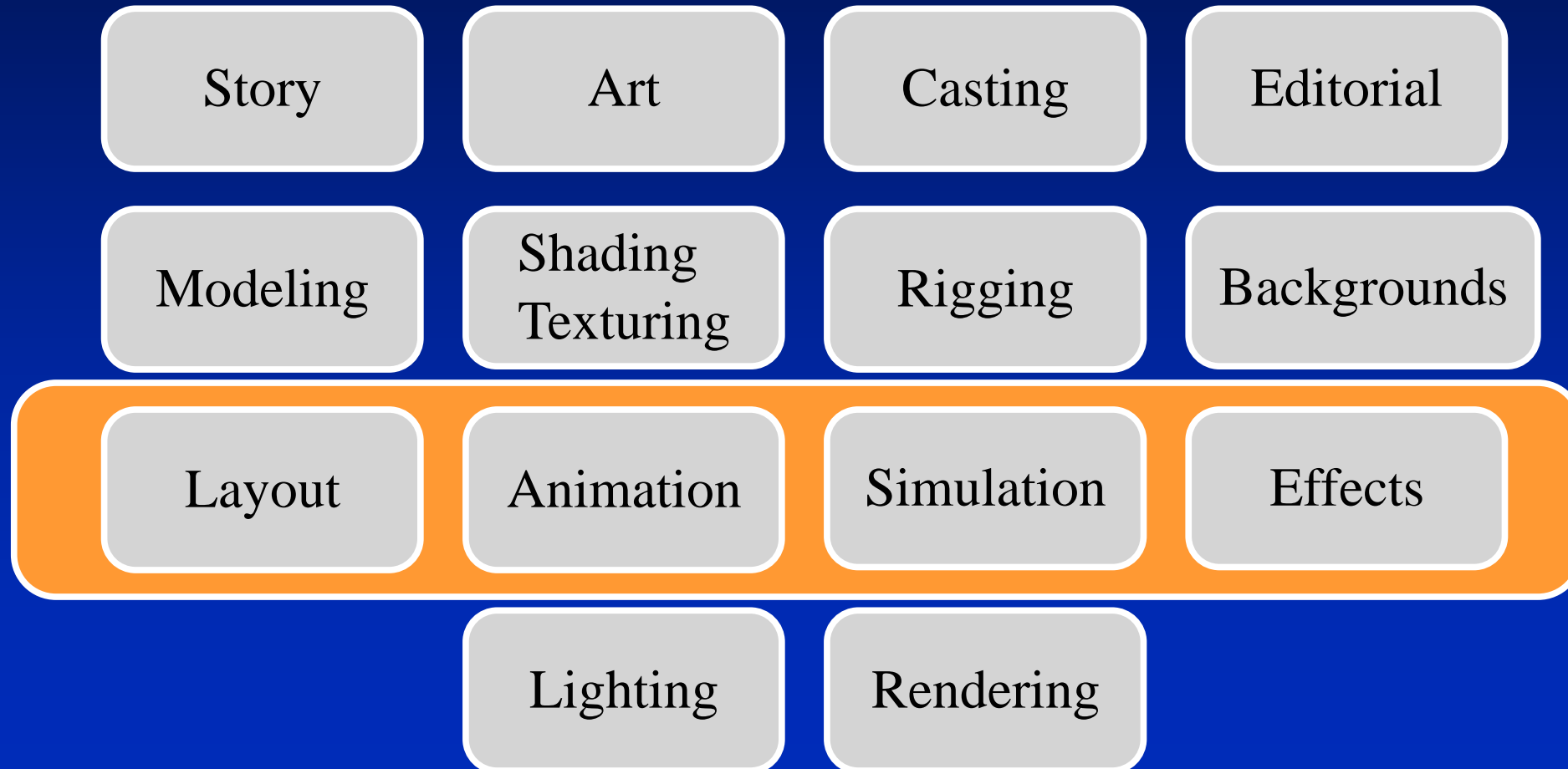


Backgrounds



The Simplified Pipeline

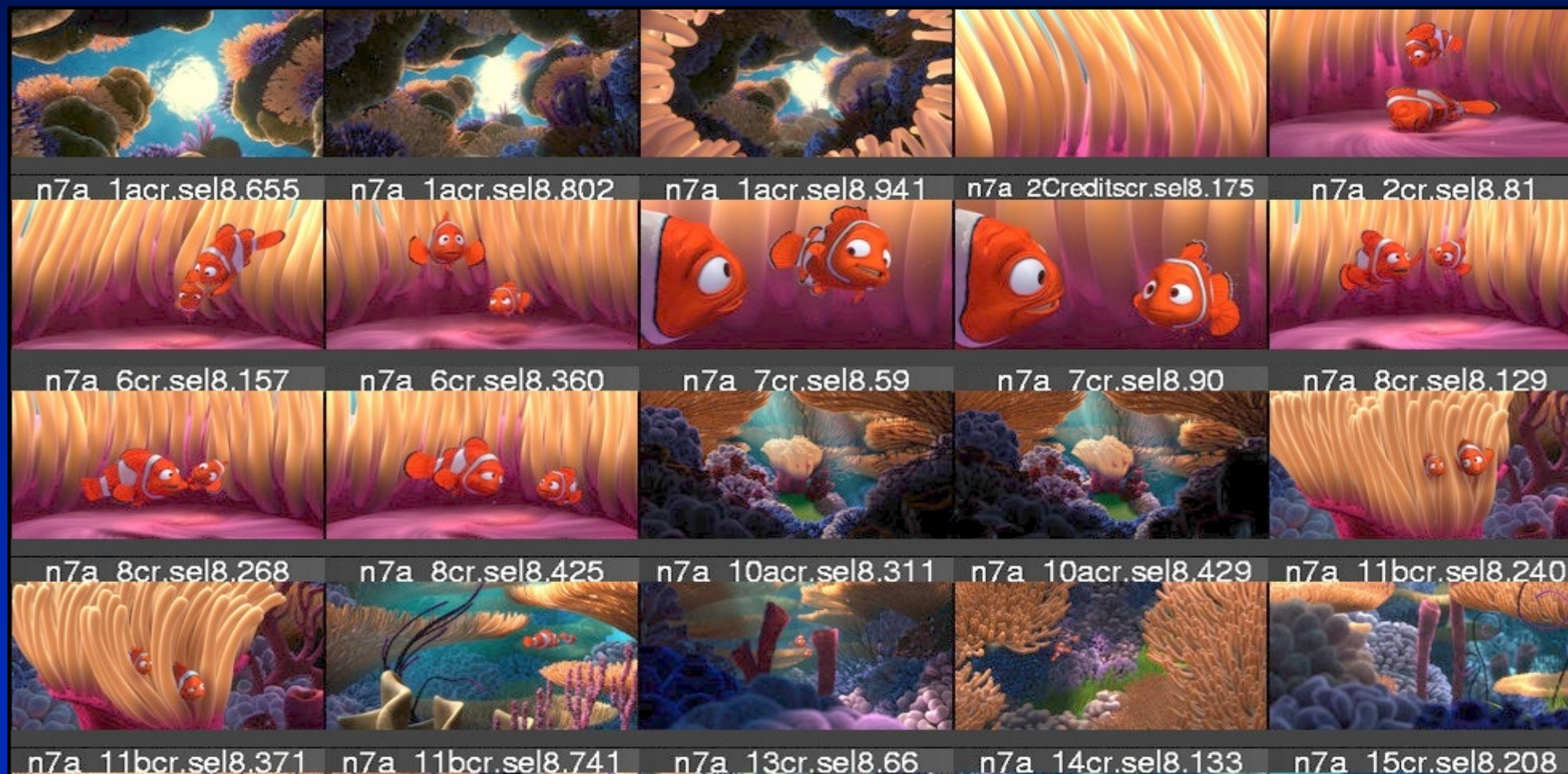
- Movement



Layout

- Defines the camera
 - Starting position
 - Framing – which objects are seen
 - Movement
- Defines basic object positions
 - Starting point for animation
- Story boards are used as reference

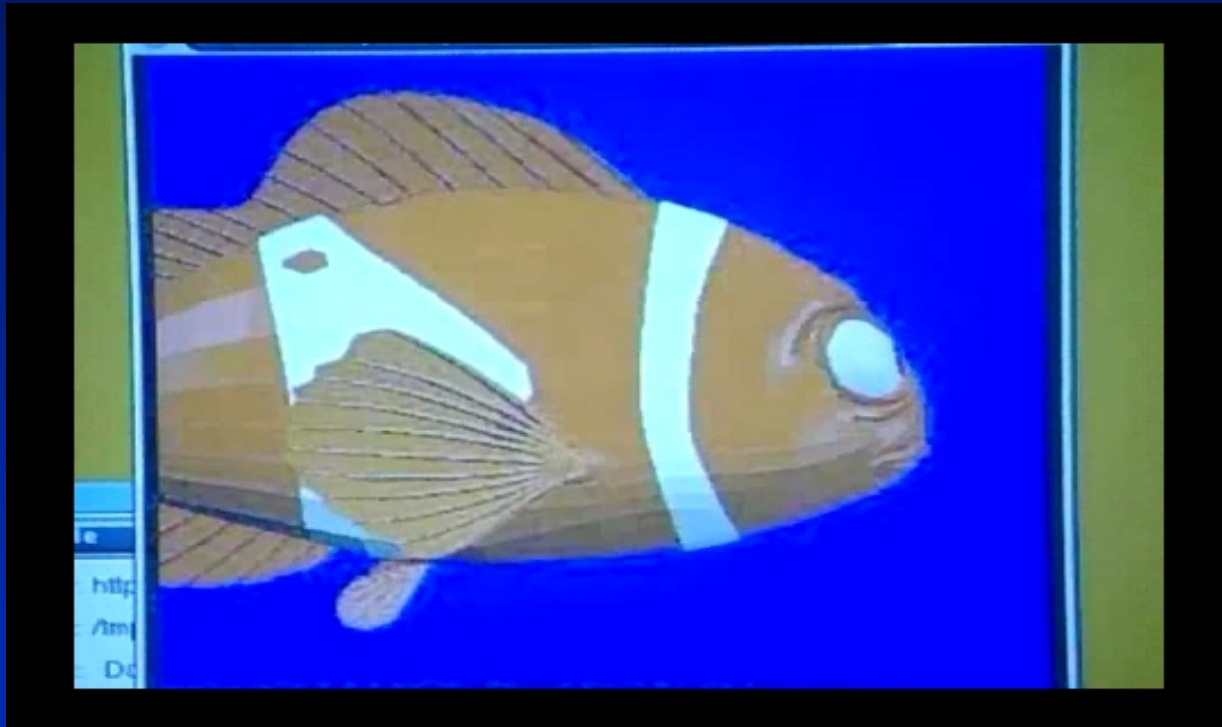
Layout



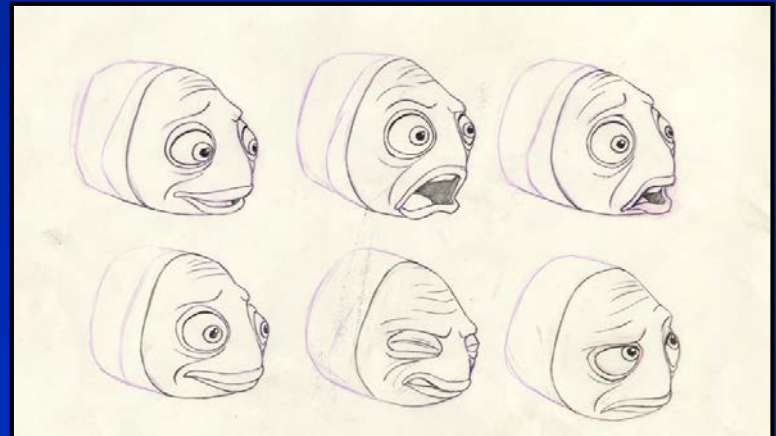
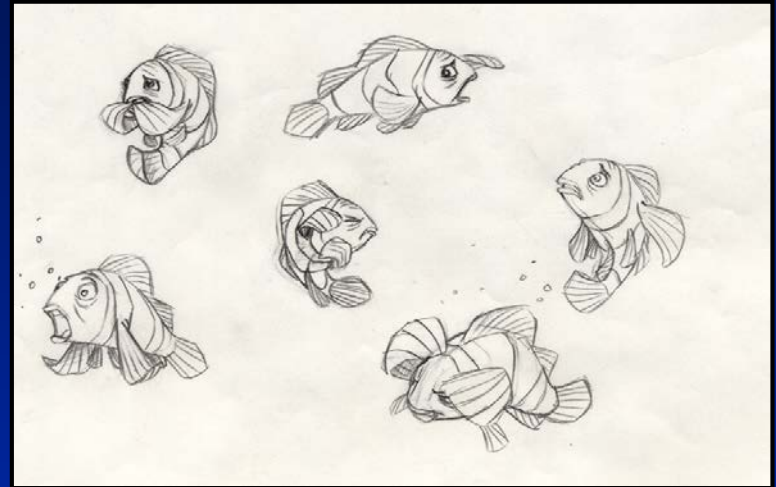
Animation

- Keyframed animation
 - Movement is specified by changing individual controls on characters at various frames
 - Similar to 2d animation
 - Used by Pixar and DreamWorks
- Motion capture
 - Movement is recorded using live actors
 - Editing to fix problems
 - Used by Sony Imageworks, Weta

Animation



© Pixar/Disney



Simulation

- Not possible to animate everything
- Physically-based animation
 - Movement is computed to simulate physics
- Applications
 - Humans: hair, cloth, skin
 - Natural media: water, fire, smoke
 - Special effects: explosions

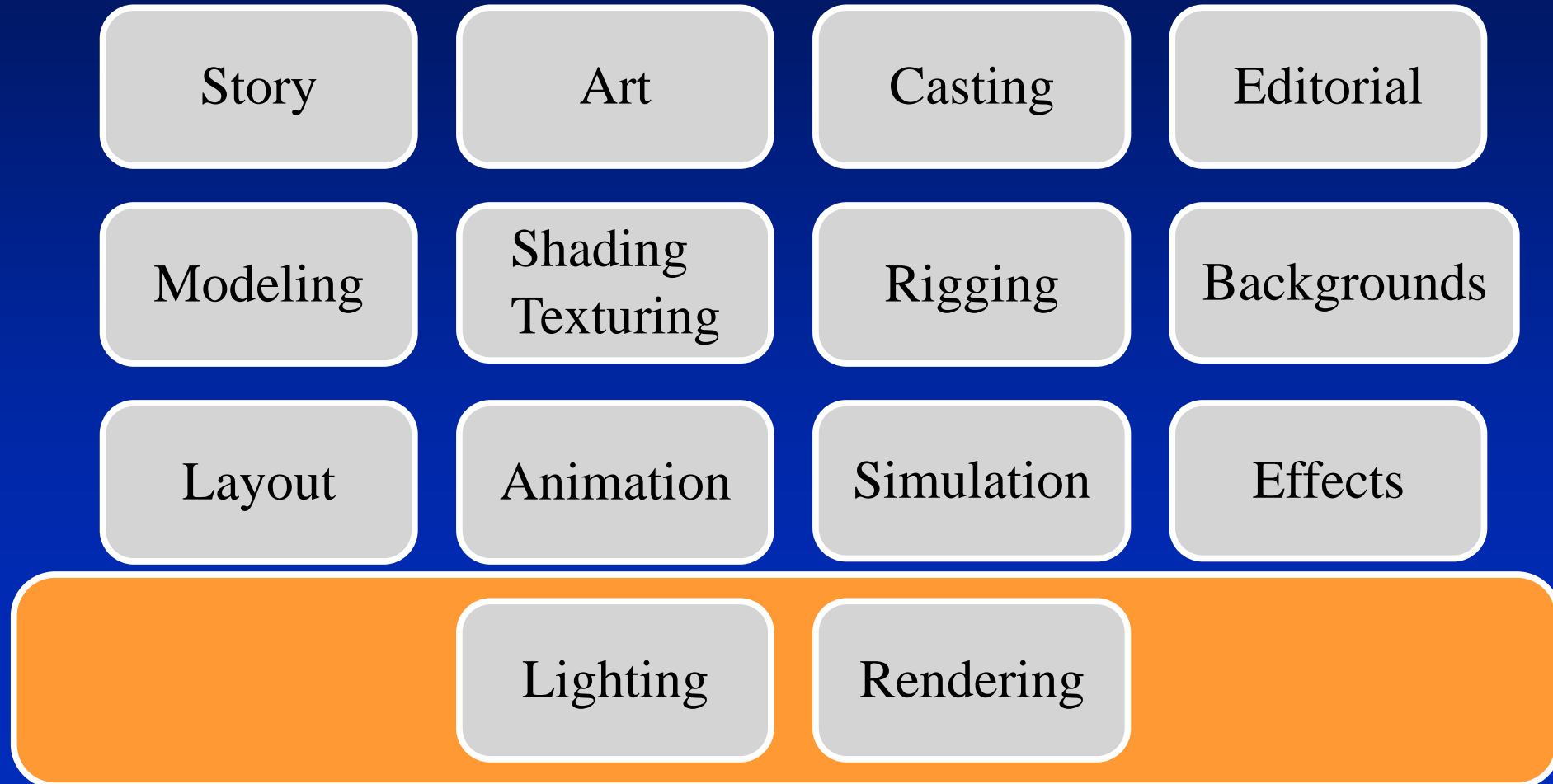
Effects

- Natural media: Water, Fire, Smoke
- Weather: Snow, Rain, Wind
- Special effects: Explosions, Morphing

- Very specific
- Encompasses modeling, animation and shading

The Simplified Pipeline

- Final images



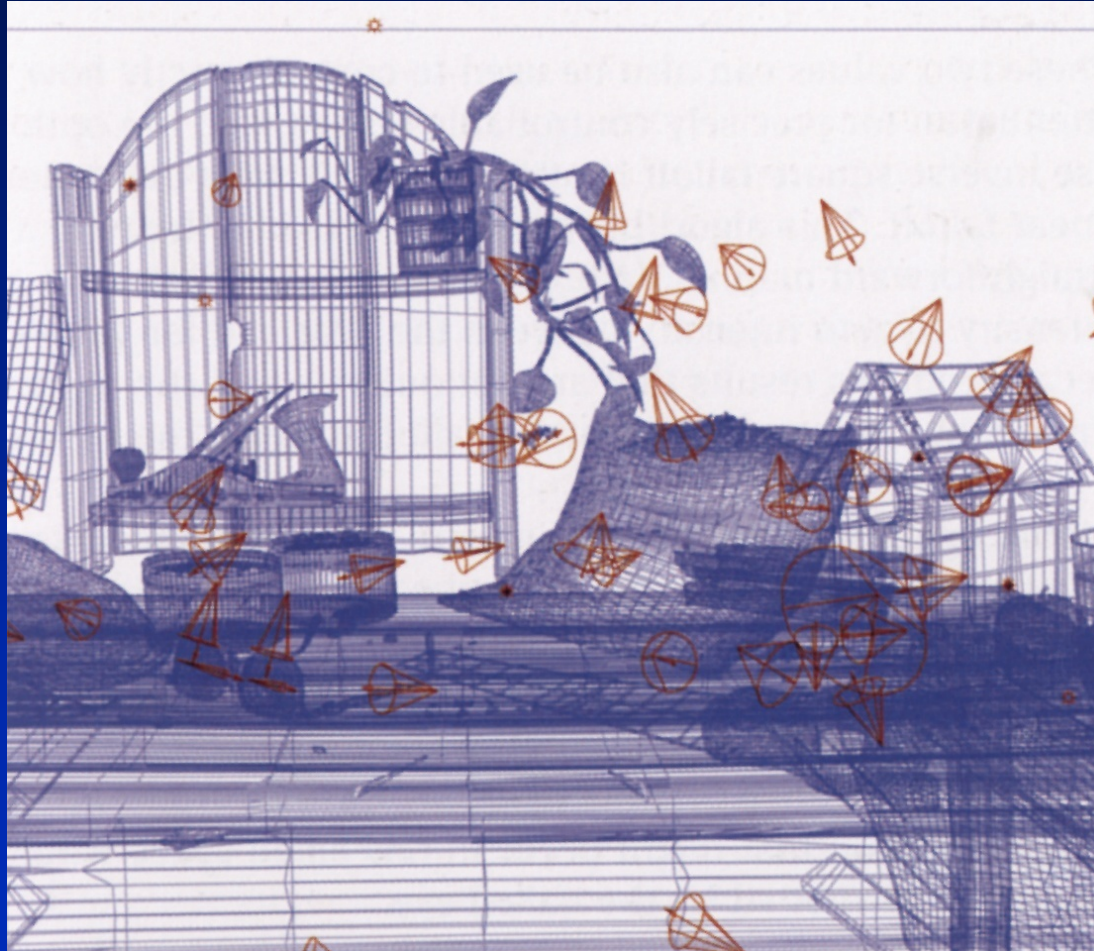
Lighting

- Defines scene illumination
- Process
 - Study real world footage
 - Study material/light interaction
 - > Simple materials: plastic, woods, etc.
 - > Complex materials: metals
 - > Characters: skin, hair
 - Start with art images
 - Add and change lights to obtain the final picture

Lighting



Lighting



Rendering

- Compute the final images



End
