

Computer Animation

Lesson 1 - Introduction

Remi Ronfard, Nov 2019

Computer Animation

Lessons, Principles, Papers

1. Introduction

2. Keyframe animation

3. Animation curves

4. Forward and inverse kinematics

5. Finite state machine

6. Motion planning

7. Camera animation

8. Rigging and skinning

9. Mass spring systems

10. Ragdoll physics

11. Forward dynamics

12. Inverse dynamics

1. Straight ahead and pose to pose

2. Arcs

3. Timing

4. Ease-in and ease-out

5. Staging

6. Follow through and overlapping action

7. Anticipation

8. Exaggeration

9. Secondary action

10. Appeal

11. Solid drawing

12. Squash and stretch

1. Improv -> Motion doodles

2. Principal components -> Improv

3. Motion doodles -> Optimo

4. The line of action

5. Sketchimo

6. Symbicon

7. Through-the-lens camera control

8. Pinocchio

9. Subdivision surfaces in character animation

10. Motion graphs

11. Artist-Directed dynamics

12. Space-time constraints

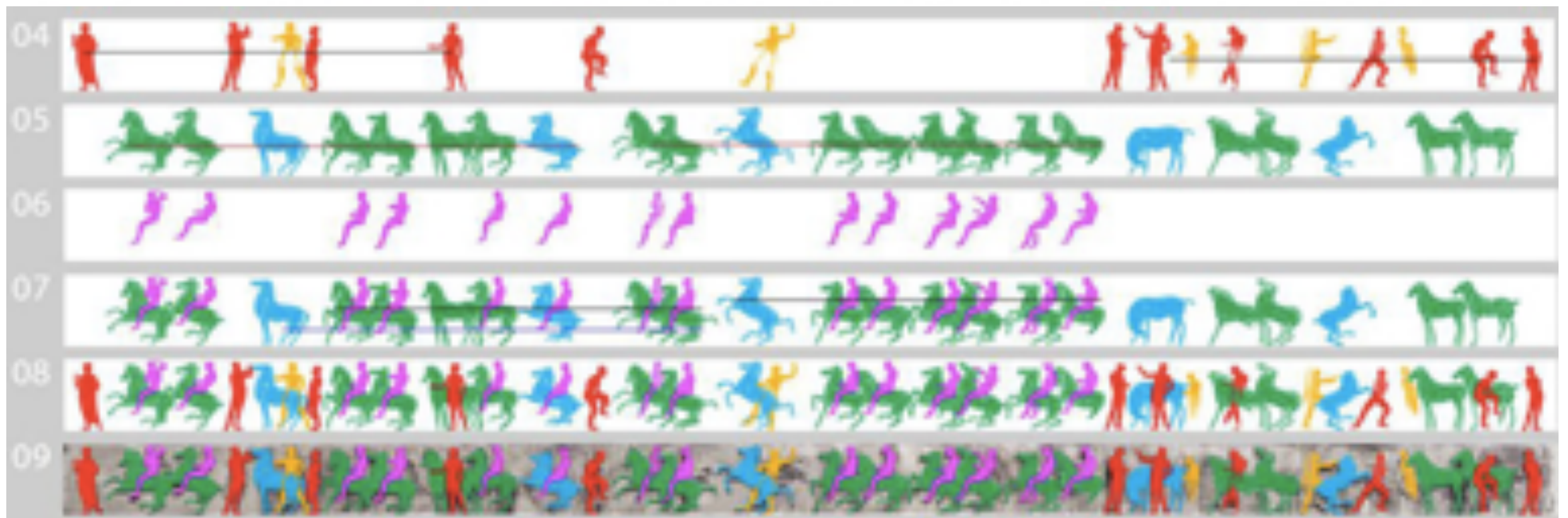
Motivation: Paleolithic animation (-32 000)



Figure 1. The Grand Panneau of the Salle du Fond at Chauvet Cave, an example of Palaeolithic graphic narration with, on both sides, two successive hunting sequences displaying cave lions (photograph: J. Clottes, Chauvet Science Team).

Motivation: Paleolithic animation (-32 000)

Motivation: Parthenon frieze (-600)

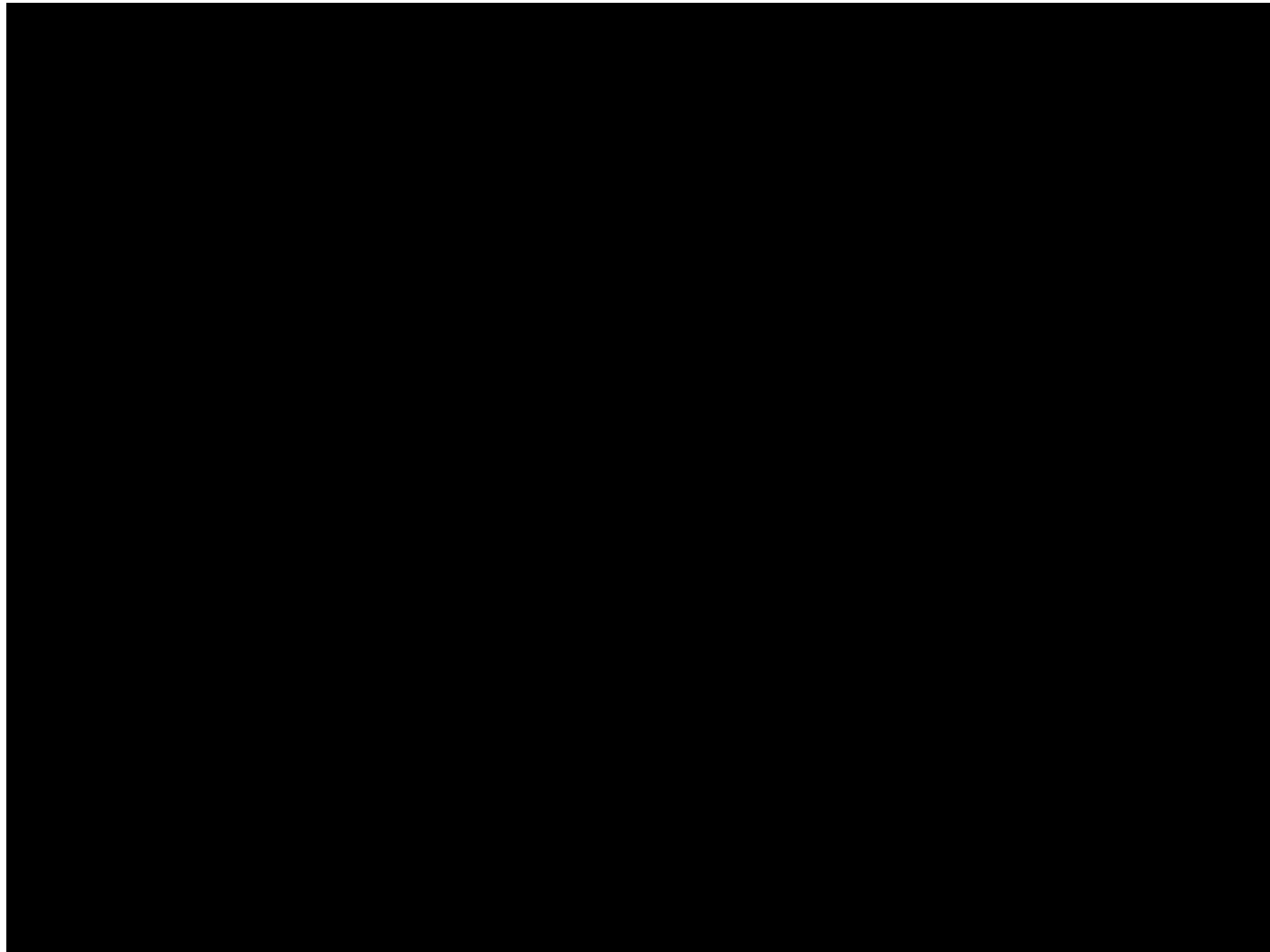


Source: Phidias the Animator. Movement Analysis in the Parthenon's Frieze. Georges Sifianos (ENSAD Paris, France).

Motivation: optical theatre by Emile Reynaud (1892)



Motivation: pauvre pierrot by Emile Reynaud (1892)



Motivation: fantasmagorie (1908)



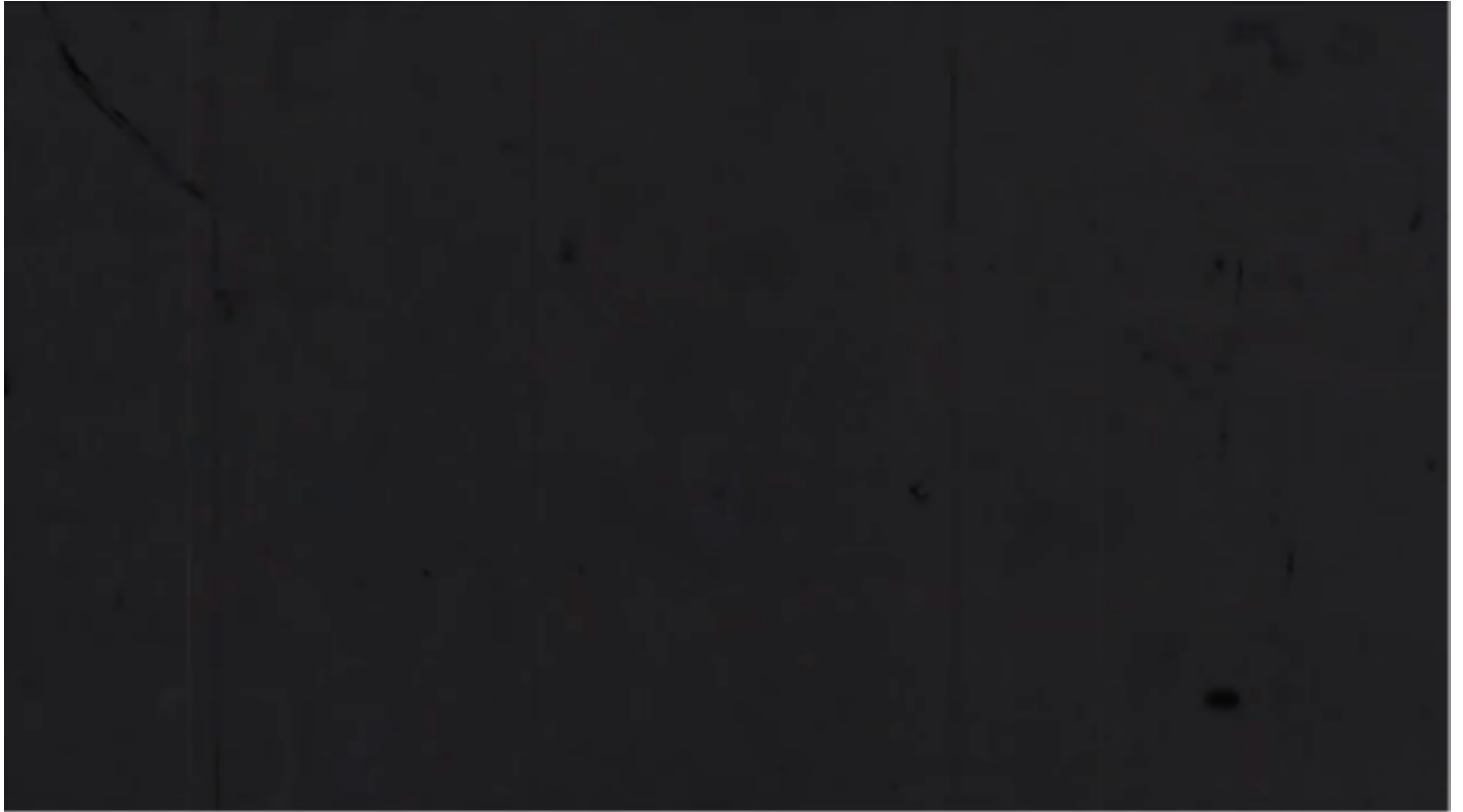
Motivation: Little Nemo (1911)



Motivation : multiplane camera (1935)



Motivation: Snow White (1937)



Motivation: sketchpad (1963)



Motivation: a computer animated hand (1972)



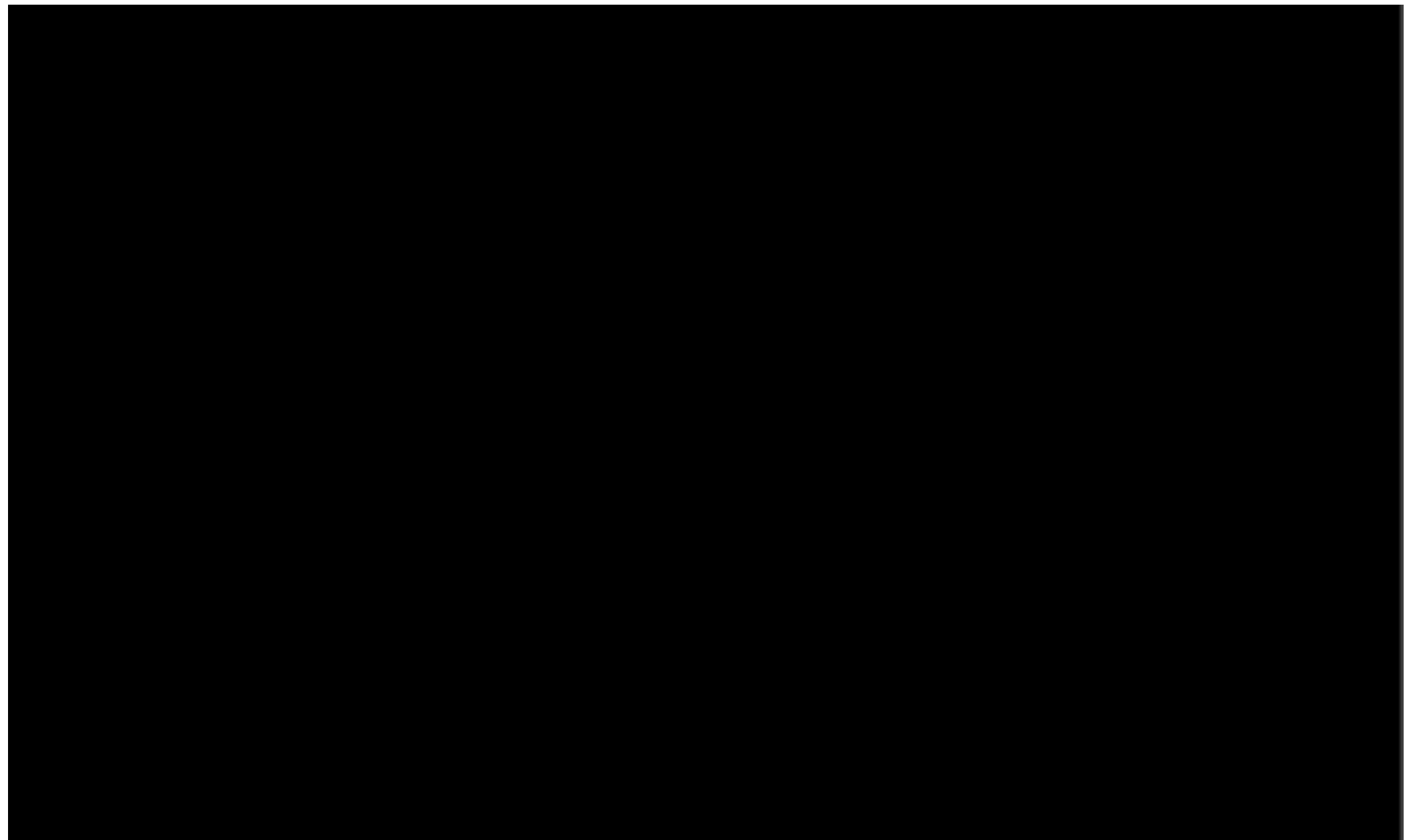
Motivation: Pixar's Luxo Jr (1986)



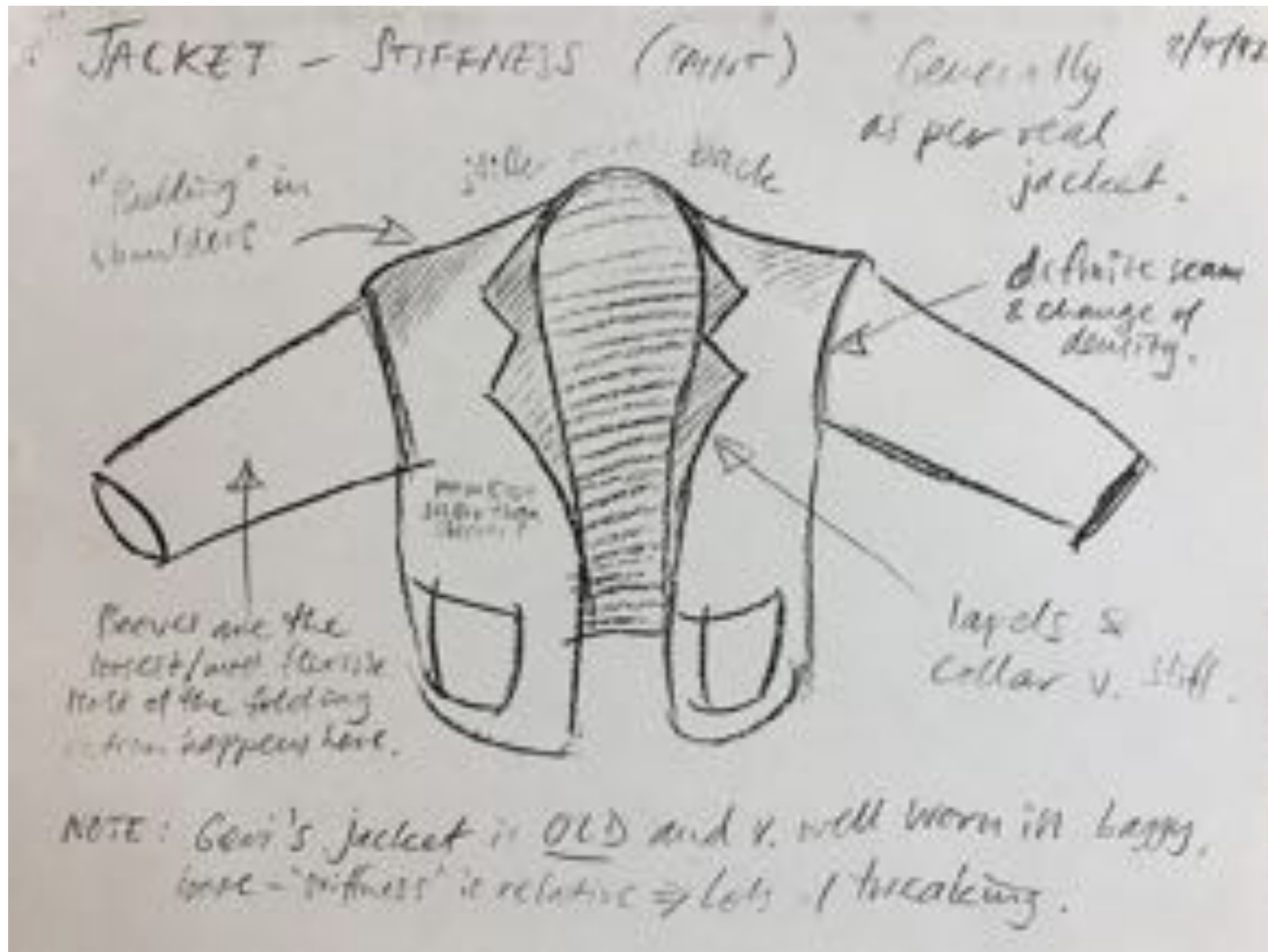
Motivation: Pixar's Toy story (1995)



Motivation: Pixar's Geri's game (1997)



Motivation: Pixar's Geri's game (1997)



Motivation: Pixar's Geri's game (1997)



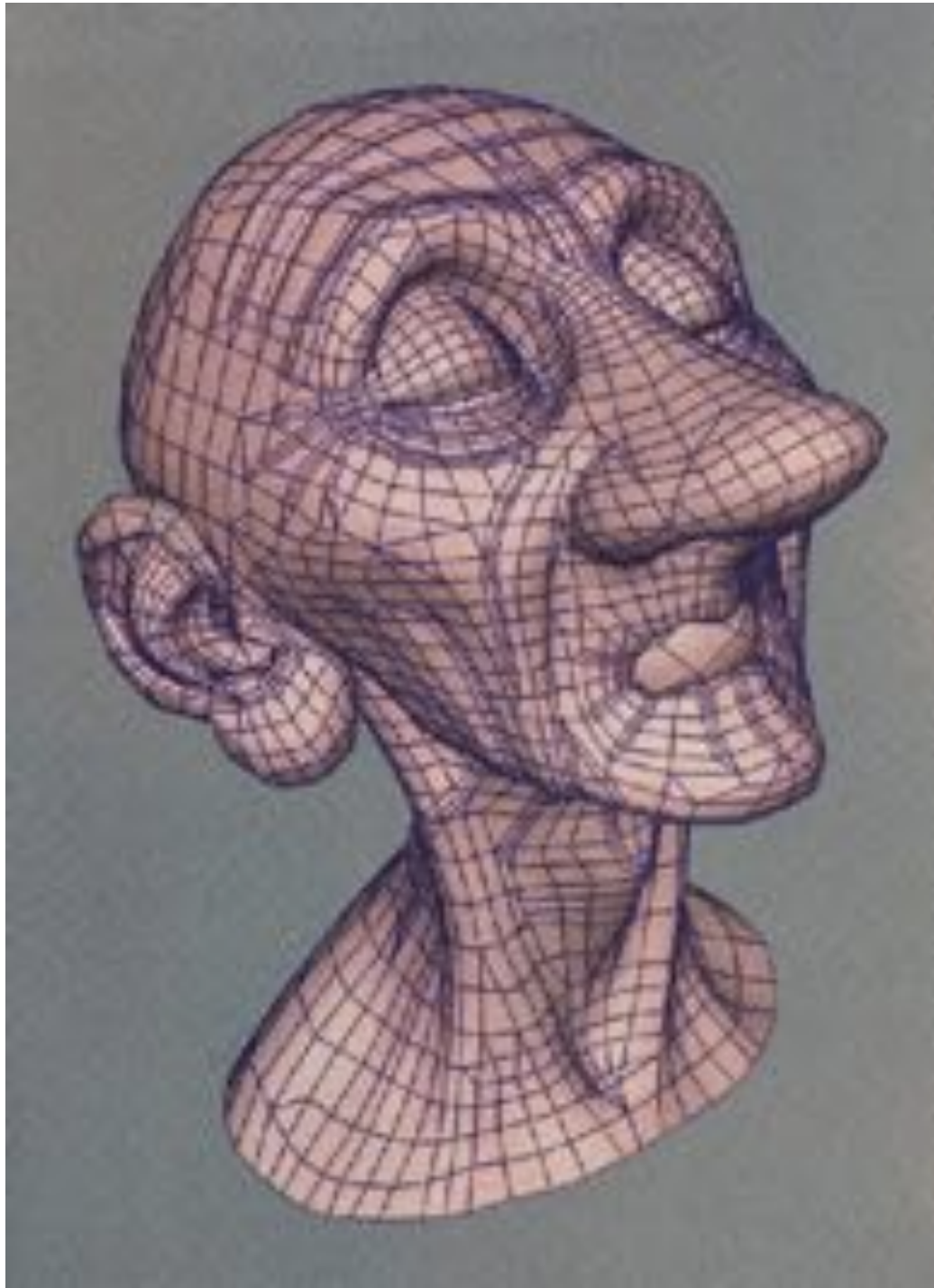
Motivation: Pixar's Geri's game (1997)



Motivation: Pixar's Geri's game (1997)



Motivation: Pixar's Geri's game (1997)



Motivation: Pixar's Geri's game (1997)



Motivation: Hayao Miyazaki and artificial intelligence (2016).

Nobuo Kawakami, Chairman, DWANGO, Co., Ltd.
(Japanese telecommunications and media company)

ドワンゴ会長
川上 量生

This is a presentation of an artificial intelligence
model which learned certain movements.

Motivation: Fable Studio and real-time animated virtual beings (2019)



PRINCIPLES OF CHARACTER ANIMATION

~1930, Studios Disney



The Illusion of Life

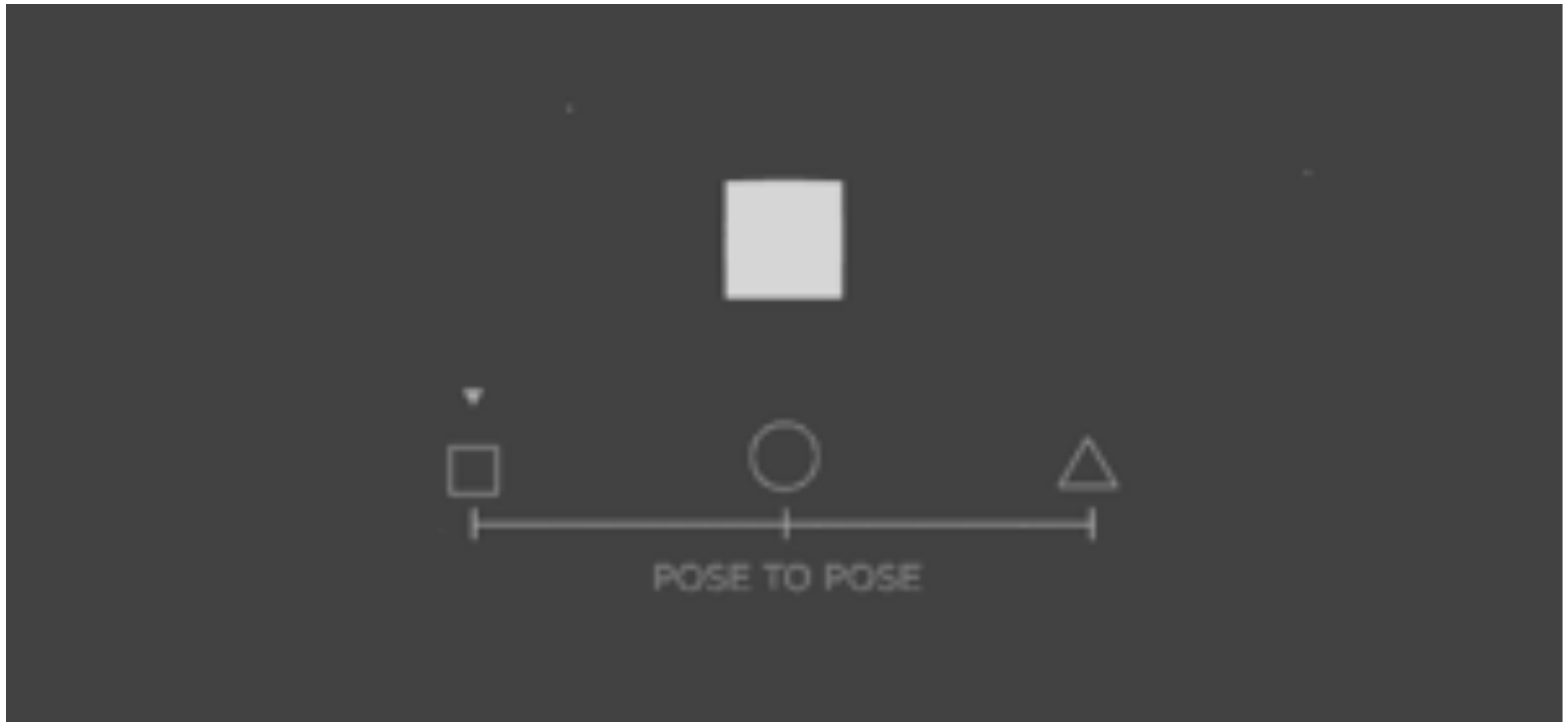
Disney's Ollie Johnston and Frank Thomas



Source

- **PRINCIPLES OF TRADITIONAL ANIMATION APPLIED TO 3D COMPUTER ANIMATION**
- **John Lasseter, Pixar, SIGGRAPH1987**

Principle 1 - Straight ahead and pose-to-pose



**4. Straight Ahead
& Pose to Pose**

Principle 1 Straight-ahead & pose to pose action

There are two main approaches to hand drawn animation. The first is known as *straight ahead action* because the animator literally works straight ahead from his first drawing in the scene. He knows where the scene fits in the story and the business it has to include. He does one drawing after another, getting new ideas as he goes along, until he reaches the end of the scene. This process usually produces drawings and action that have a fresh and slightly zany look, because the whole process was kept very creative. Straight ahead action is used for wild, scrambling actions where spontaneity is important.

The second approach is called *pose-to-pose*. Here the animator plans his actions, figures out just what drawings will be needed to animate the business, makes the drawings concentrating on the poses, relates them to each other in size and action, and then draws the inbetweens. Pose-to-pose is used for animation that requires good acting, where the poses and timing are all important.

Paper 1. Improv: A System for Scripting Interactive Actors in Virtual Worlds (1996)

Improv: A System for Scripting Interactive Actors in Virtual Worlds

Ken Perlin / Athomas Goldberg
Media Research Laboratory
Department of Computer Science
New York University

Paper 1. Improv: A System for Scripting Interactive Actors in Virtual Worlds (1996)



Paper 1. Improv: A System for Scripting Interactive Actors in Virtual Worlds (1996)

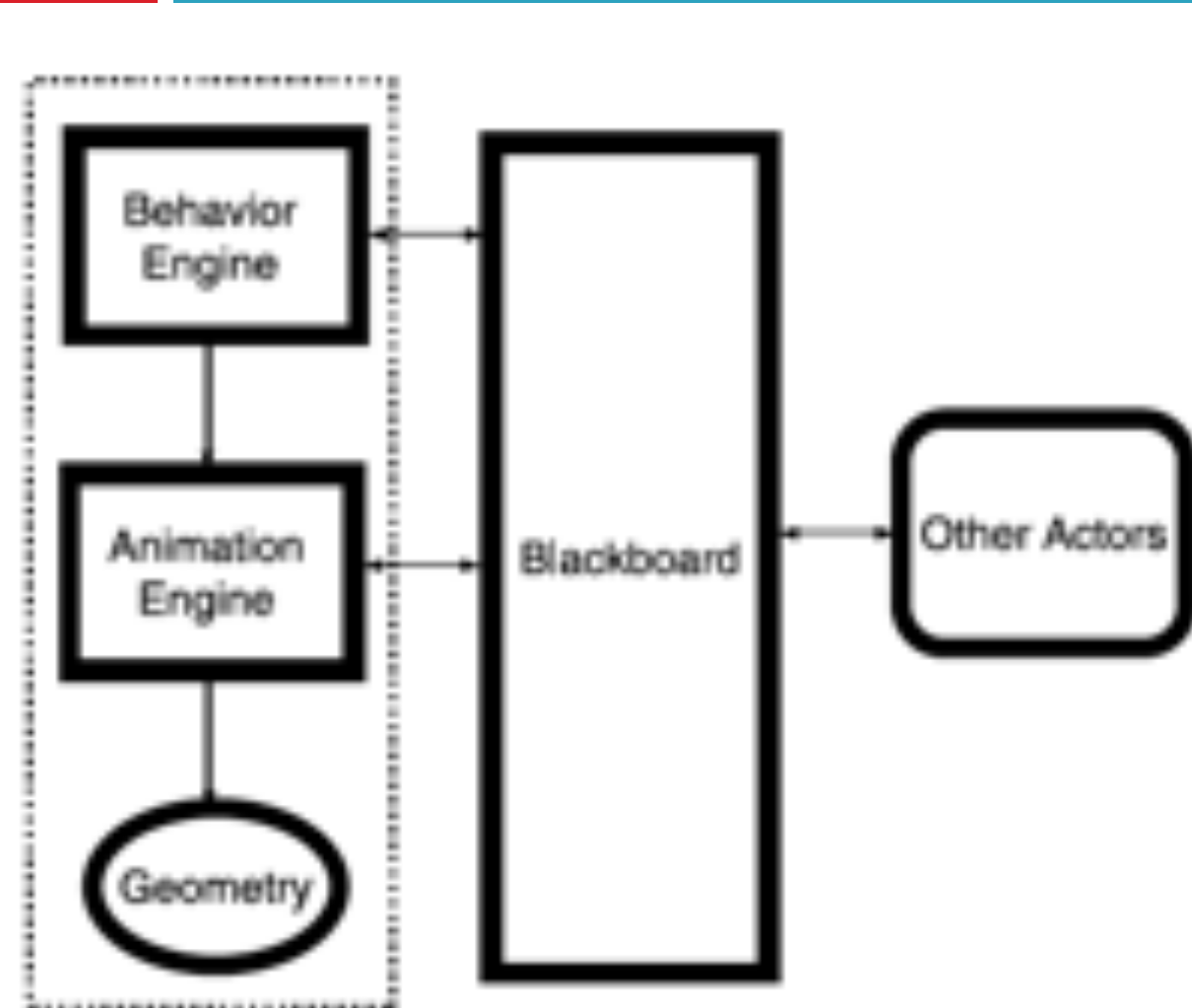


figure 4: Actors communicate with each other through a shared blackboard.

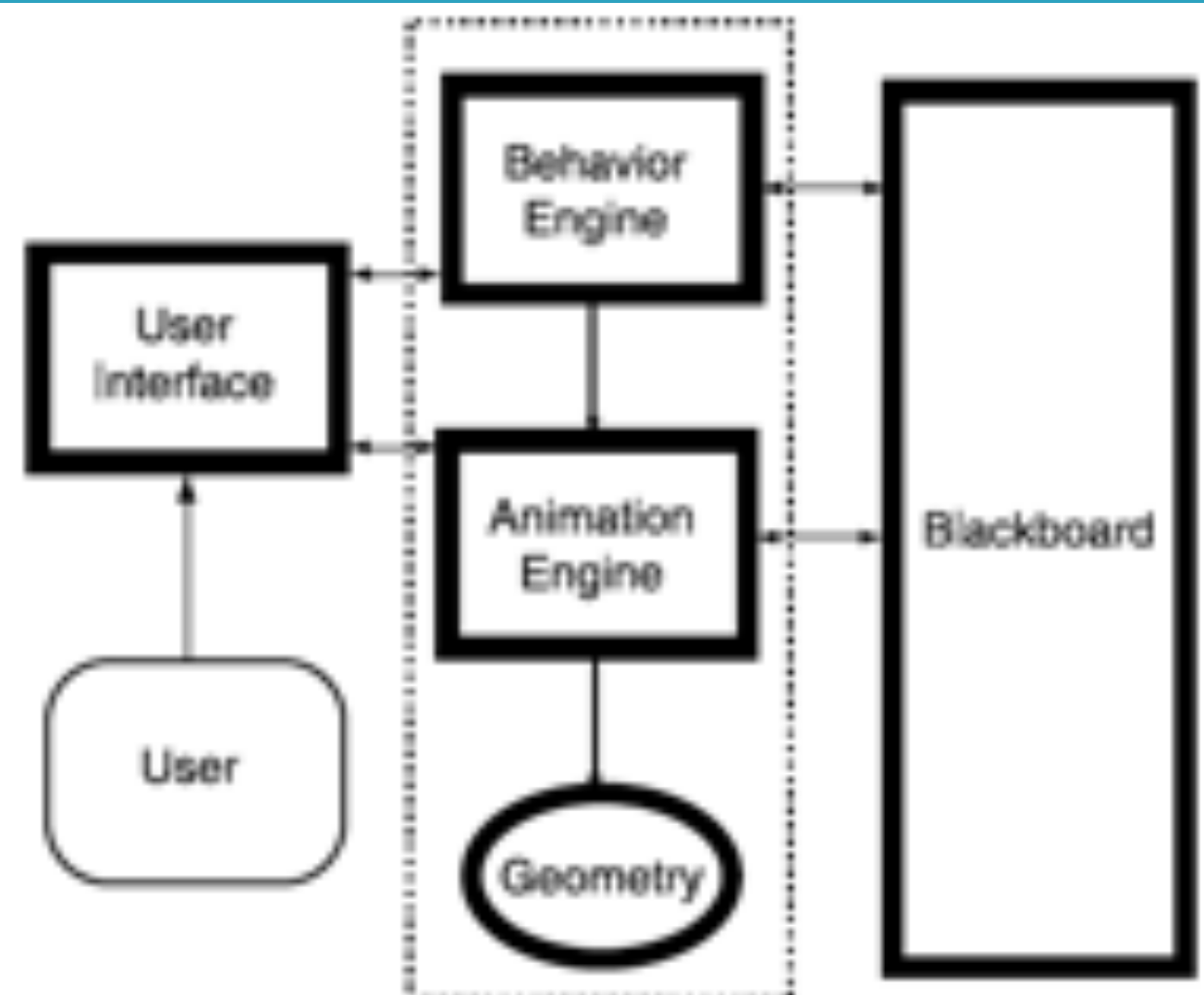


figure 5: Users interact with both the Behavior Engine and the Animation Engine through an author-defined user-interface.

Paper 1. Improv: A System for Scripting Interactive Actors in Virtual Worlds (1996)

- 1) Description**
- 2) Clarity of Exposition**
- 3) Quality of References**
- 4) Reproducibility**
- 5) Strengths and weaknesses**
- 6) Rating (1-5)**

Paper 1. Improv: A System for Scripting Interactive Actors in Virtual Worlds (1996)

- 1) Problem statement**
- 2) Scientific contributions**
- 3) Experimental validation**
- 4) Limitations**
- 5) Impact**