

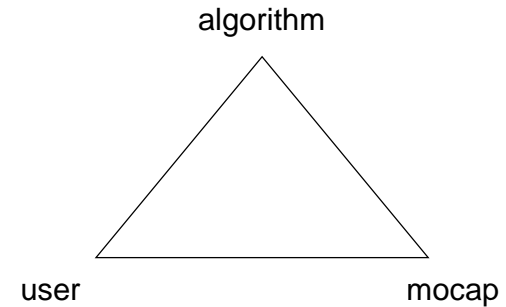


# Introduction to Computer Animation

*Michiel van de Panne*



# Animation Sources



# Motion Notation

- 1700 “Choregraphie”, Feuillet
- 1852 “Stenochoregraphie”, Arthur Saint Leon
- 1928 “Notation of Movement”, Margaret Morris
- 1928 “Schrifttanz”, Rudolf von Laban
- 1940 “Kinetography Laban” (Labanotation)
- 1950’s Eshkol & Wachmann: mathematical notation
- 1956 “Choreology”, Joan and Rudolf Benesh



# Motion Notation

## Labanotation

“Labanotation”,  
Ann Hutchinson

double starting line.

2a Actions on the right side only

b An action on the right then on the left side

c A left-sided action followed by simultaneous actions on both sides

This vertical center line forms the basis of the vertical three-line staff on which structured description is written.

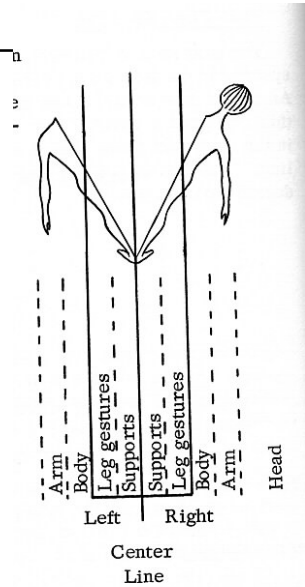


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# Motion Notation

## Labanotation

"Labanotation", Ann Hutchinson



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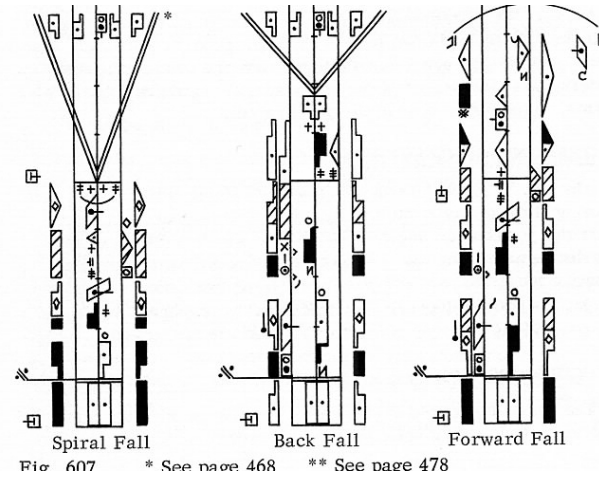


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# Motion Notation

## Labanotation

"Labanotation", Ann Hutchinson



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# Animation History

## Film Animation

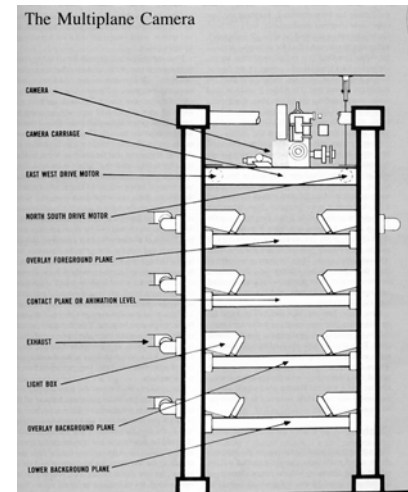
- 1914 Windsor McCay – Gertie the Dinosaur
- 1923 Walt Disney, "Alice in Wonderland"
- 1928 Walt Disney, "Mickey Mouse"
- 1969 Burtnyk & Wein, NRCC, computer keyframing
- 1988 Pixar "Tin Toy"
- 1995 Pixar "Toy Story", full-length CG film
- 2001 Square "Final Fantasy", CG people

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# Traditional Animation



(from "The Illusion of Life" Frank Thomas and Ollie Johnson)

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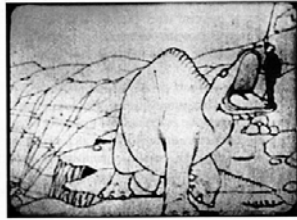
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# Traditional Animation



ANIMATOR: Winsor McCay—  
Gertie the Dinosaur.

Cartoonist Winsor McCay was the first to recognize animation as an art form. His best remembered film is Gertie the Dinosaur, done in 1914. Historian John Canemaker points out that Gertie was the first animated personality, showing shyness and stubbornness and eventually weeping big tears when she was criticized. The audience loved it, but ten years later both the film and the techniques had been forgotten.



(from "The Illusion of Life" Frank Thomas and Ollie Johnson)

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# Traditional Animation



(from "The Illusion of Life" Frank Thomas and Ollie Johnson)

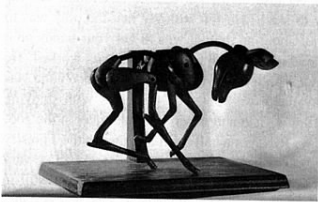
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# Traditional Animation

Expert model-makers constructed a jointed armature of a young deer for the animators to study while working on Bambi. Based on Rico Lebrun's drawings, everything moved correctly, right down to the toes.



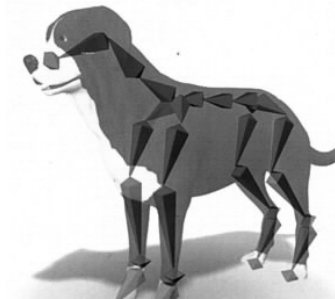
(from "The Illusion of Life"  
Frank Thomas and  
Ollie Johnson)

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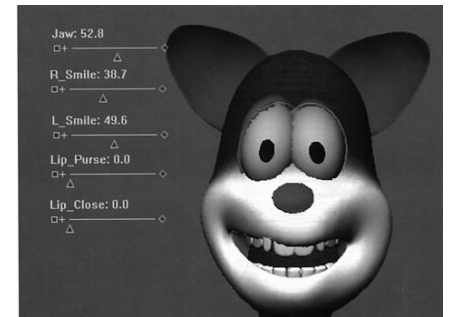


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# 3D Animation (keyframing)



p. 151, "[digital] character animation 2",  
G. Maestri



p. 44, "[digital] character animation 2",  
G. Maestri

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## 3D Animation (keyframing)

### Issues

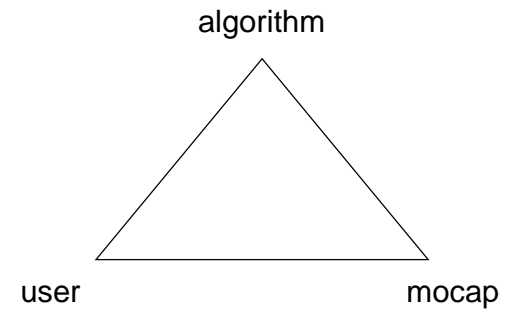
- complete control over motion
- rigging character
- time consuming
- not real-time

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## Animation Sources



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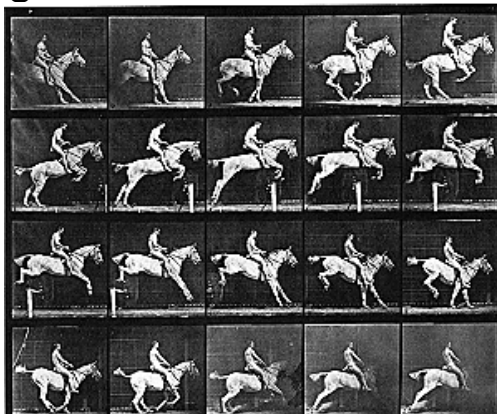


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## Motion Capture

*Muybridge, 1884*

*Rotoscoping*



(Figure from  
"Animals in Motion",  
Muybridge)

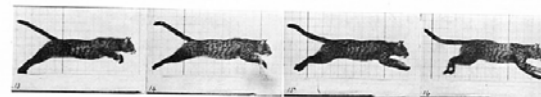
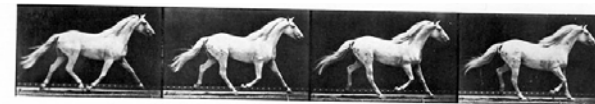
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## Motion Capture

*Muybridge*



(Figure from  
"Animals in Motion",  
Muybridge)

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# Motion Capture



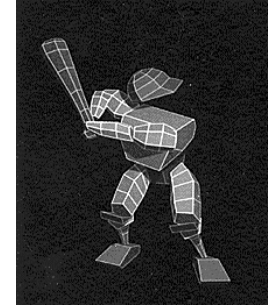
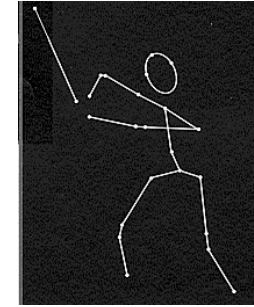
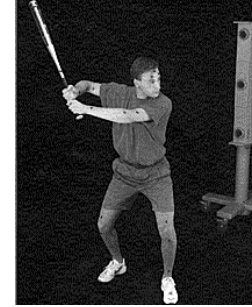
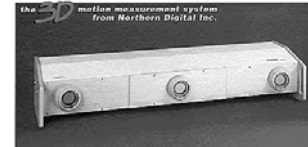
(Figure from Ascension Inc.)

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# Motion Capture



(Figure from Northern Digital Inc.)

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# Motion Capture

## Issues

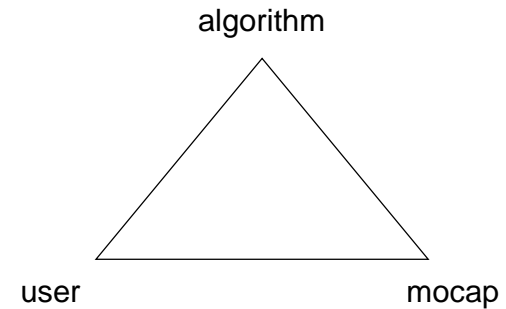
- modifying mocap data
- building graphs
- annotation of data
- data cleanup
- data compression

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# Animation Sources



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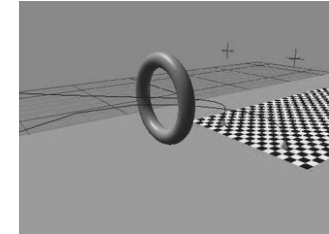
## Physics-based Simulation

### *Issues*

- realistic
- simulation parameters?
- difficult to control

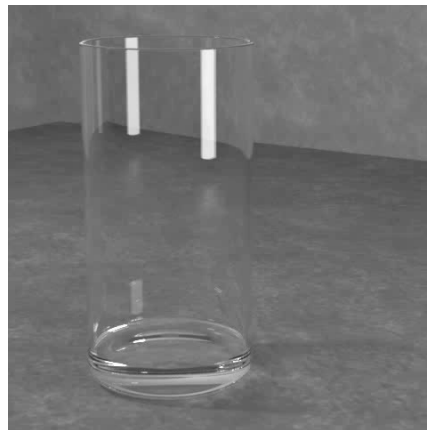
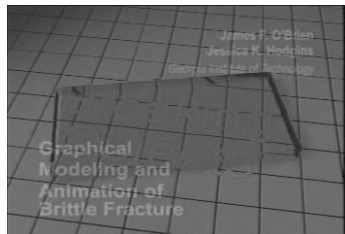
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## Simulation of Passive Motion



© Michiel van de Panne

## Simulation of Passive Motion



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## Active Motions

### • *multidisciplinary*

- biomechanics
- brain sciences
- kinesiology
- robotics
- machine learning
- control theory

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# Simulation of Active Motion



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