University of British Columbia

Introduction to Computer Animation

CPSC 526

History of Animation

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Animation Sources

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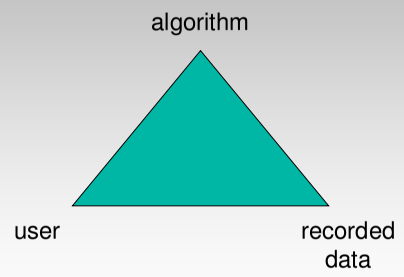


History of Motion Notation

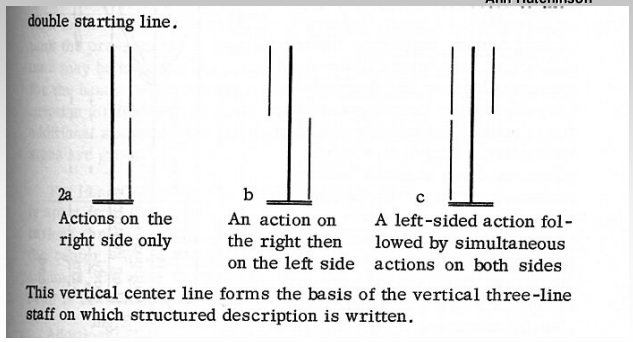
University of British Columbia

- 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

University of British Columbia

“Labanotation”, Ann Hutchinson



Motion Notation

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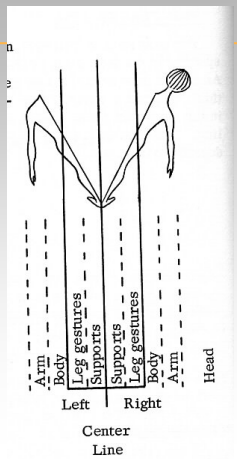
“Labanotation”, Ann Hutchinson



Motion Notation

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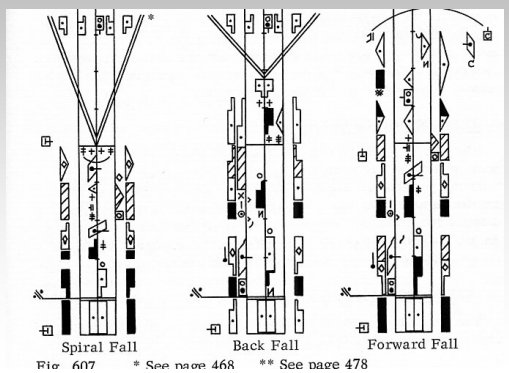

"Labanotation", Ann Hutchinson

Fig. 607 * See page 468 ** See page 478

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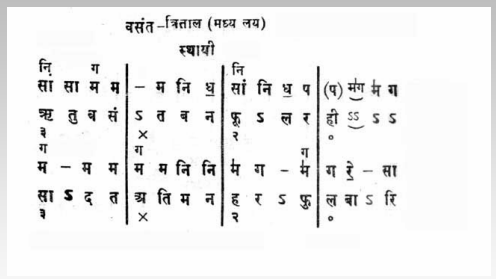

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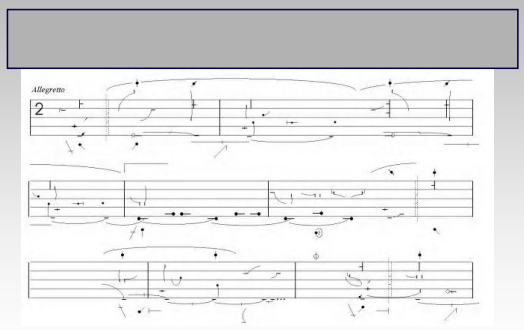

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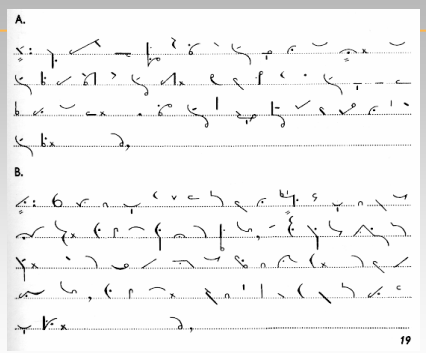

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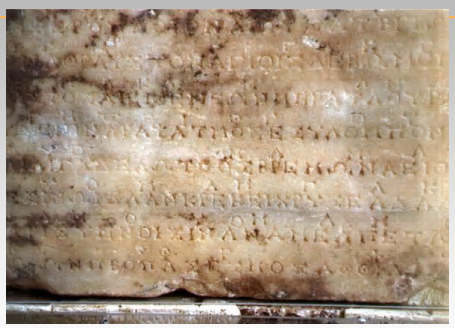

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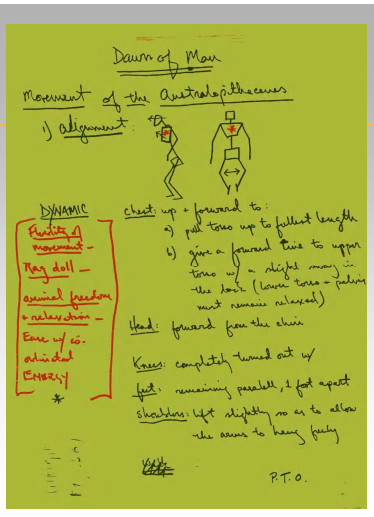

Early Efforts

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Flipbook
Magic Lantern (17th Century)
Thaumatrope (1826)
Zoetrope (1834)
Phenakistoscope (1838)
Polyrama Panoptique (1860)
Praxinoscope (1877)

http://cs.wcsu.edu/joelw/GFX/intro.ppt

Flipbook

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Each page contains one of a sequence of images

When flipped, an illusion of motion is produced

Magic Lantern

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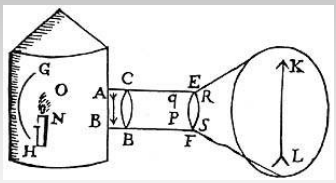
17th Century



Thaumatrope

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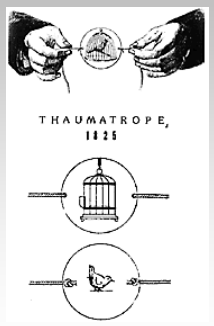
William Henry Fitton (1826)

A two-sided disk (bird on one side, cage on the other) with a central string

Images merge when disk was spun



Zoetrope
(ZOH-uh-trohp)

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Invented by William George Horner (1834)

Based on the persistence of vision property

Appeared in the US in 1837

Phenakistoscope

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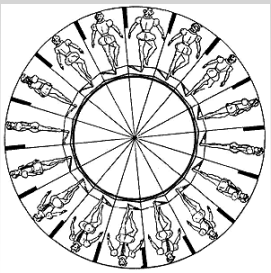
Joseph Antoine Ferdinand Plateau (1832) (Also Simon Ritter von Stampfer – Stroboscope)

- The inner disk held the pictures in order on the rim
- The viewer looked through slits in an outer



Polyrama Panoptique

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French (1860)

When doors are opened and closed in the top and back the pictures change from day to night

Based on Daguerre's Diorama

Praxinoscope

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Emile Reynaud (1877)

Based on Zoetrope

First to project a moving image onto a big screen

Film / Video / HDTV / ...

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IMAGO, The European Federation of Cinematographers, member of EDCF, would like to introduce the following suggestions...

1. Request for support of 60 fps frame rate. The DCI specification document does allow for a frame rate above 24 fps. However, it allows for 48 fps only. We do not recommend the introduction of 48 fps and would rather propose 60 fps for the following reasons: Although 48 fps is quite good performance wise, damage will happen to material shot at 48 fps when transferred to video for TV and home entertainment distribution after the cinema run. Indeed, frame rate conversions do cause considerable damage to moving images. A frame rate of 60 fps would yield and even better quality than 48 fps and interface better with the subsequent TV and home entertainment career of the movie. It will only require 25% more bandwidth, which is marginal. Also, since 60 fps is already an established frame rate in daily use in the moving image industry, we would recommend it would be supported anyhow. With so much 60 fps material in existence and in daily production, risks may be high that proprietary systems might emerge if 60 fps is not included from the start into the standard. Additionally, 48 fps introduces a new frame rate into the moving image industry. An industry that already suffers from too many different frame rates. We would prefer to see a reduction of the number of commonly used frame rates in the industry, given that frame-rate conversions do a lot of damage to moving imagery. In the actual industry we already have to deal with 24, 25, 30, 50 and 60 fps presentation speeds, let us please not add one more.

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3. Request to allow for frame rate change during the show.
Frame rate changes during the movie will allow higher frame rates to be used more economically in the beginning (by limiting the higher frame rates to specific scenes within the movie). This should be possible without visible joint. The use of frame rate changes will then probably disappear later on when the higher frame rates become more economical, and entire movies can be shot and run at the higher speed at acceptable costs. Till then, frame rate changes may allow for a significantly better quality cinema experience.

Walt Disney

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1919:

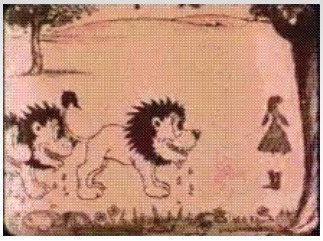
- Forms Iwerks-Disney Commercial Artists with Ub Iwerks
- Hired by Kansas City Film Ad Company
- In spare time, creates *Laugh-O-Grams* for Newman Theater Company

Walt Disney

University of British Columbia

1923-26:

- Creates *Alice's Wonderland*, and other Alice films, which combined a live-action Alice with animation



Animation History

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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

Traditional Animation

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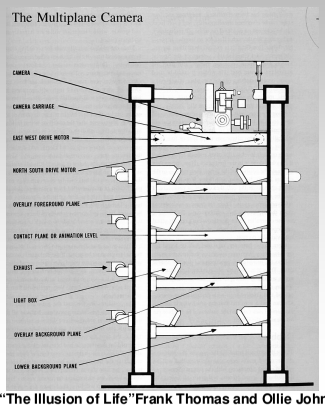
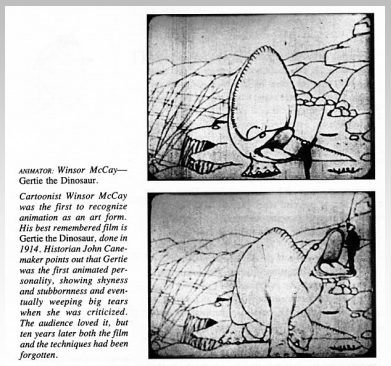


(from "The Illusion of Life"Frank Thomas and Ollie Johnson)

Traditional Animation

University of British Columbia



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)

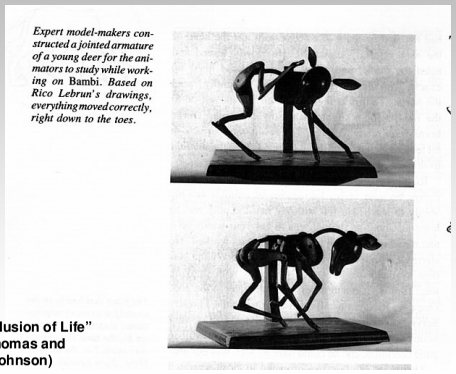
Traditional Animation

University of British Columbia

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

Traditional Animation

University of British Columbia



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)

Burtnyk & Wein

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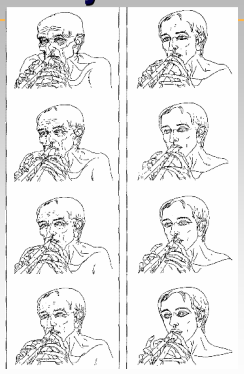

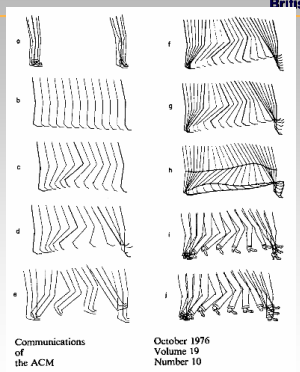

Communications of the ACM

October 1976 Volume 19 Number 10

Principles of Traditional Animation "The Illusion of Life"

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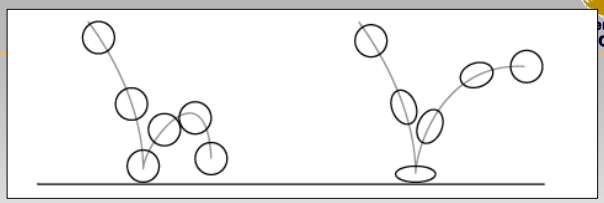
- Squash and stretch
- Slow In and out
- Anticipation
- Exaggeration
- Follow through and overlapping action
- Timing
- Staging
- Straight ahead action and pose-to-pose action
- Arcs
- Secondary action
- Appeal



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Cartoon Laws of Physics
Authorship Unknown

Cartoon Law I
Any body suspended in space will remain in space until made aware of its situation. Daffy Duck steps off a cliff, expecting further pastureland. He loiters in midair, soliloquizing flippantly, until he chances to look down. At this point, the familiar principle of 32 feet per second per second takes over.

Cartoon Law II
Any body in motion will tend to remain in motion until solid matter intervenes suddenly. Whether shot from a cannon or in hot pursuit on foot, cartoon characters are so absolute in their momentum that only a telephone pole or an outsize boulder retards their forward motion absolutely. Sir Isaac Newton called this sudden termination of motion the stooge's surcease.

Cartoon Law III
Any body passing through solid matter will leave a perforation conforming to its perimeter. Also called the silhouette of passage, this phenomenon is the specialty of victims of directed-pressure explosions and of reckless cowards who are so eager to escape that they exit directly through the wall of a house, leaving a cookie-cutout-perfect hole. The threat of skunks or matrimony often catalyzes this reaction.

Cartoon Law IV
The time required for an object to fall twenty stories is greater than or equal to the time it takes for whoever knocked it off the ledge to spiral down twenty flights to attempt to capture it unbroken. Such an object is inevitably priceless, the attempt to capture it inevitably unsuccessful.

Cartoon Law V
All principles of gravity are negated by fear. Psychic forces are sufficient in most bodies for a shock to propel them directly away from the earth's surface. A spooky noise or an adversary's signature sound will induce motion upward, usually to the cradle of a chandelier, a treetop, or the crest of a flagpole. The feet of a character who is running or the wheels of a speeding auto need never touch the ground, especially when in flight.

Keyframing Styles

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***Straight ahead** is what it sounds like: the animator just charges in and starts animating in a very stream of consciousness sort of way. This results in some genuinely inspired animation that flows extremely well. It also ends up in alot of dead ends and wasted effort when the animator realizes he's painted himself into a corner.*

***Pose to pose** animation is also much as it sounds, The animator picks some seminal poses that, when timed correctly, capture the energy and direction of the shot.The animator then will go and create these poses and hit the timings, working to deliver the shot with structure. This often times ends up with some of the most powerful animation with very strong poses and tight timing, distilling the animation down to the very core of it's being. It also often ends up looking stiff and mechanical and very stilted when the animator isn't careful to think about keeping things alive.*

http://www.keithlango.com/tutorials/old/popThru/popThru.html

3D Animation (keyframing)

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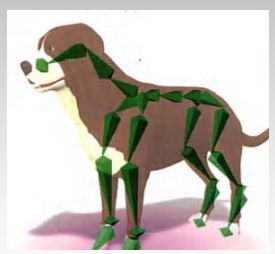

p. 151, "[digital] character animation 2", G. Maestri

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

Blend Shapes

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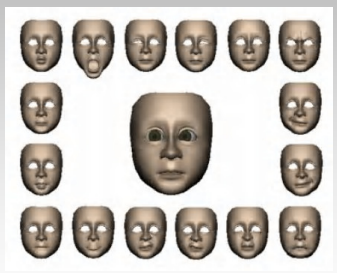

3D Animation (keyframing)

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Issues

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

Animation Sources

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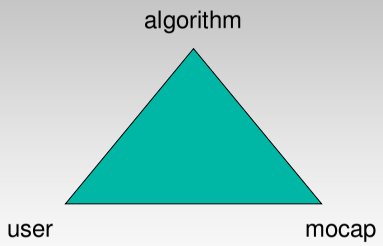

Motion Capture

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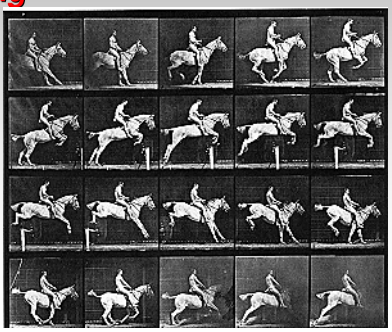
Muybridge, 1884

Rotoscoping



(Figure from "Animals in Motion", Muybridge)

Motion Capture

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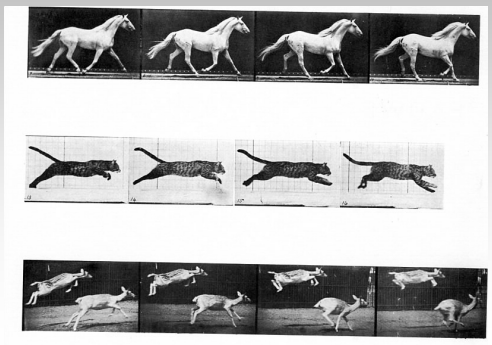
Muybridge



(Figure from "Animals in Motion", Muybridge)

Polhemeus 6 DOF

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(Figure from Ascension Inc.)

Passive Optical

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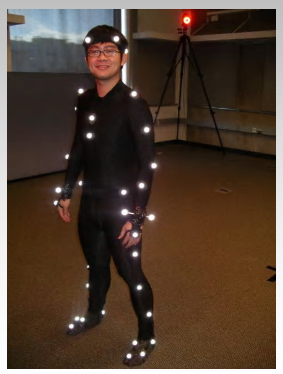

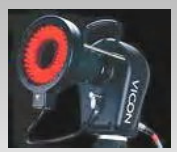

EA: 86 MX40

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Active Optical

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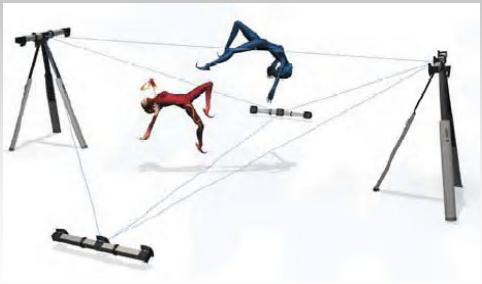

Mechanical

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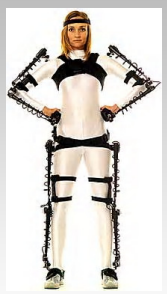

Gyros

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Shape Tape

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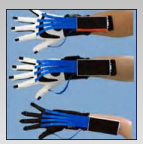

Ultrasound

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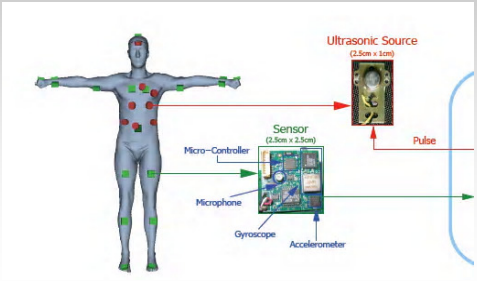

Video

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Video

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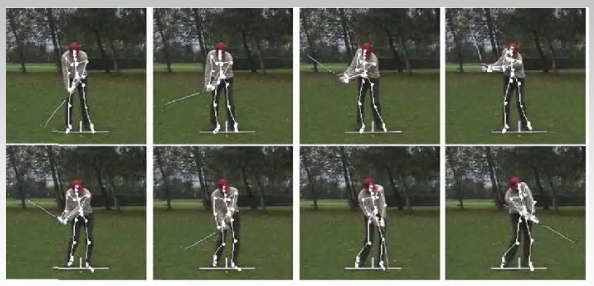

Motion Capture

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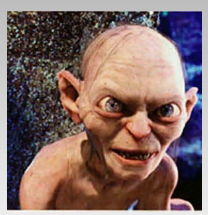
Issues

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

– performance animation

Mori's "Uncanny Valley"

University of British Columbia



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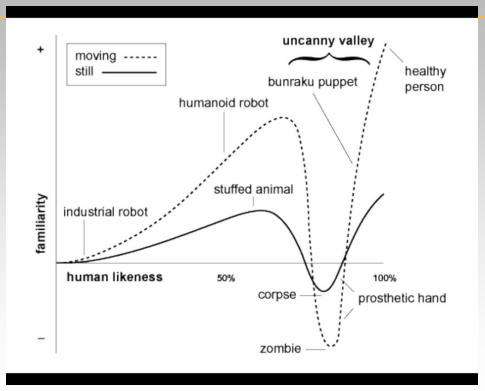

Animation Sources

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