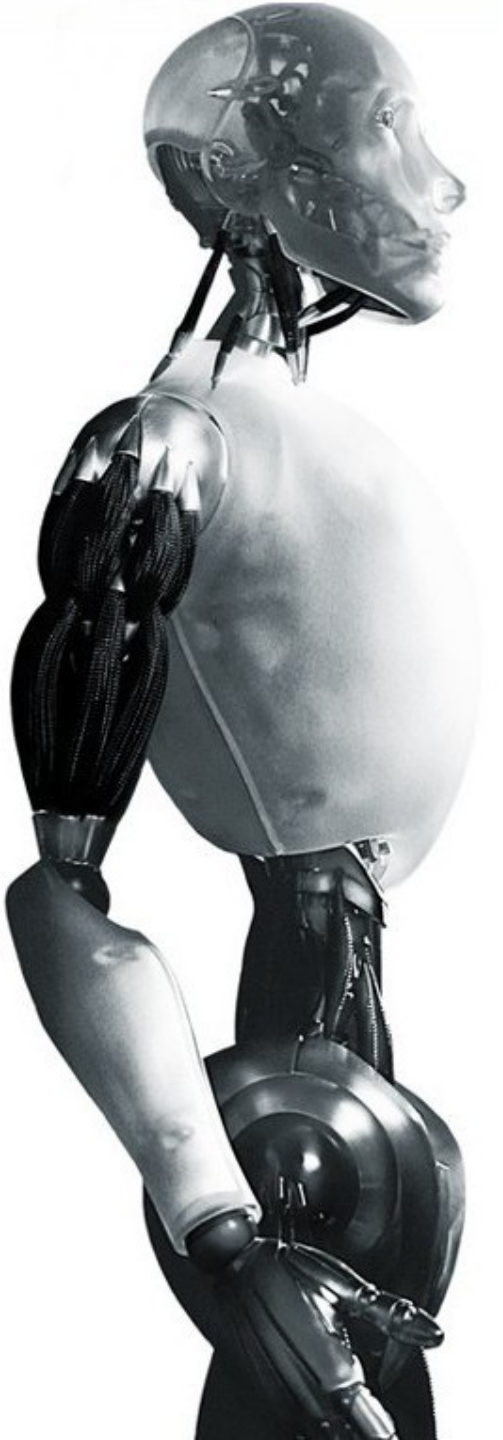
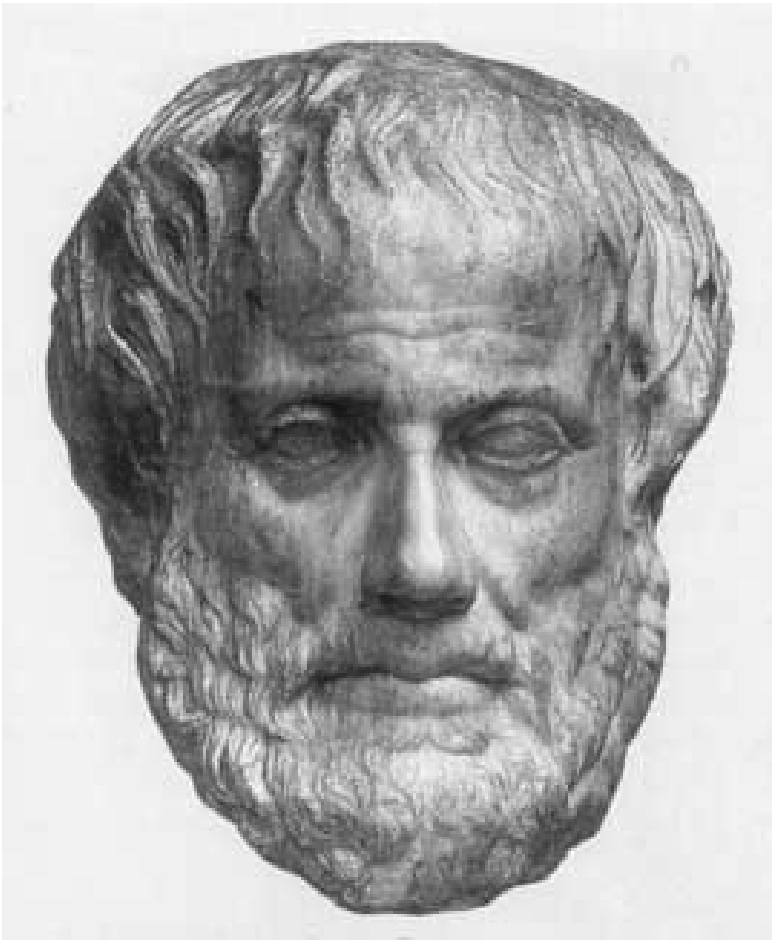


Robotics

Excerpts from the History of Robotics

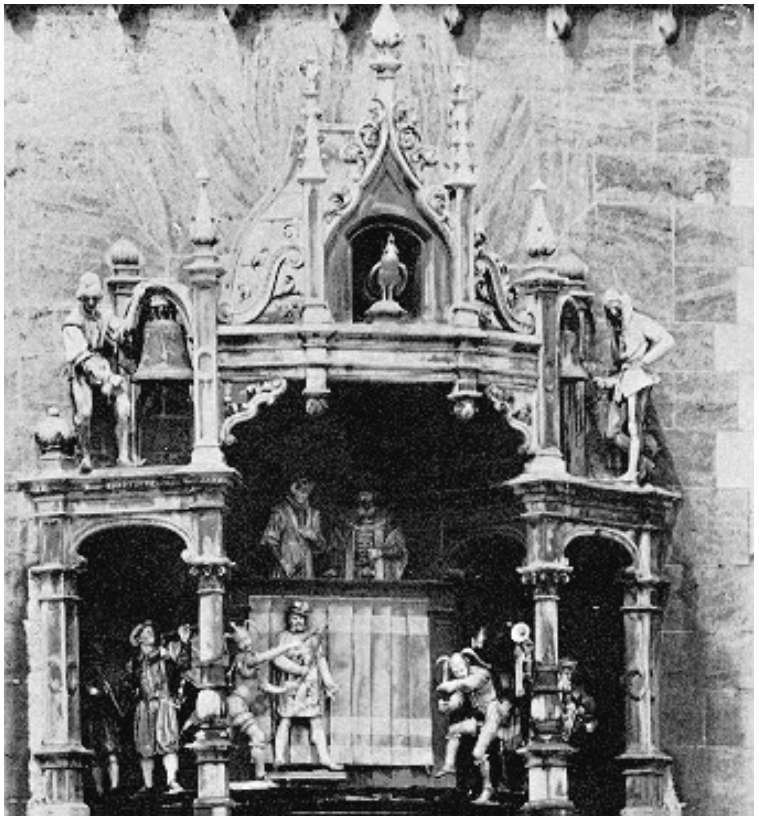
TU Berlin
Oliver Brock

Aristotle



Early Robots

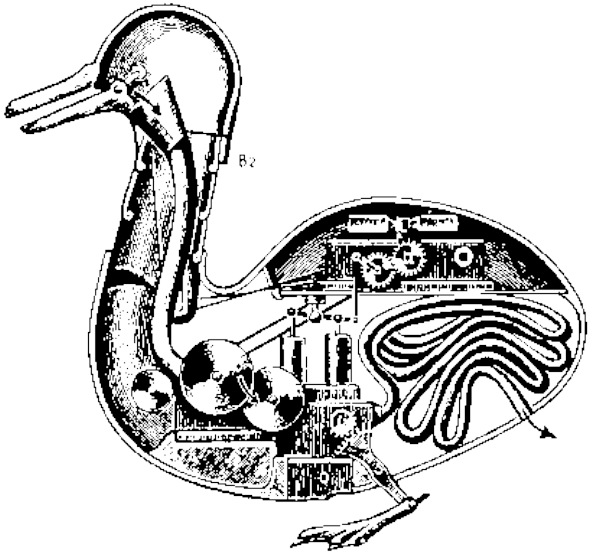
1350 Rooster flapping wings and on top of Cathedral in Strasbourg, France

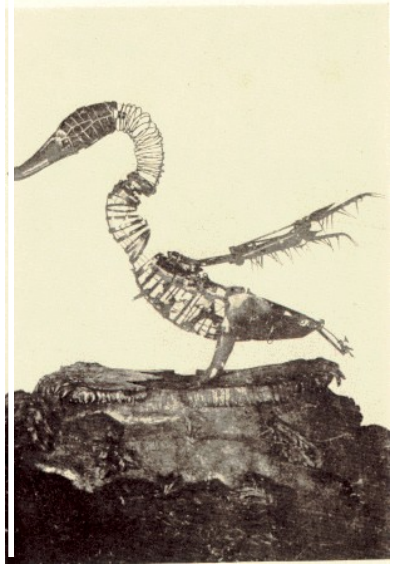


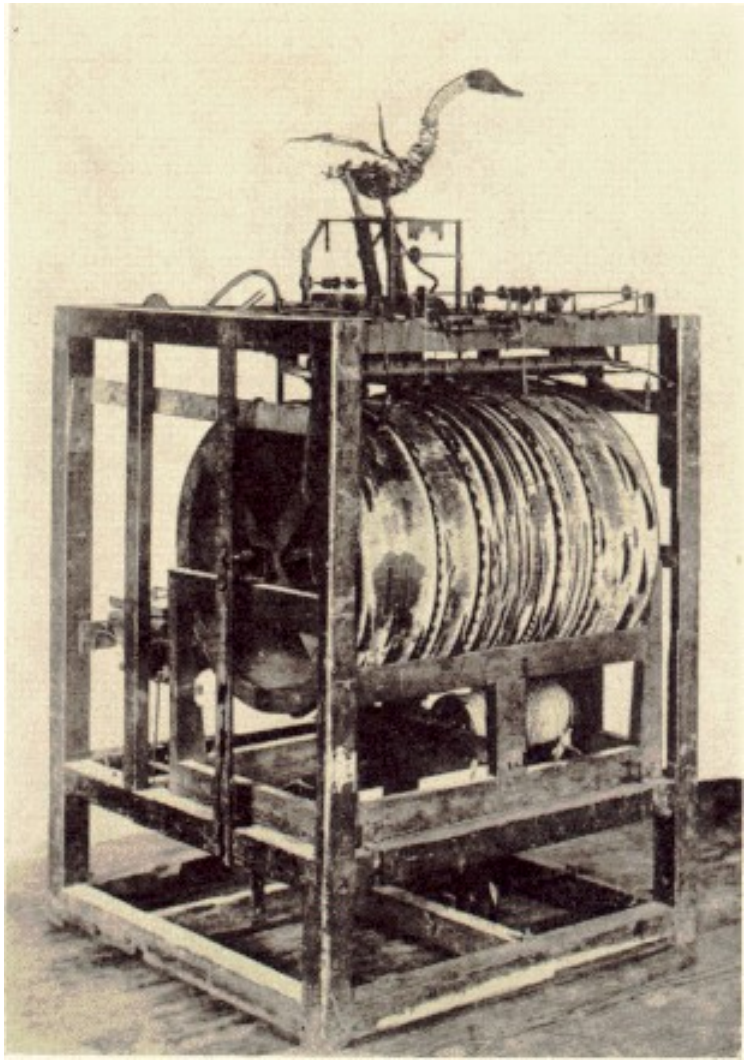
Town Hall, Munich, Germany Renaissance

1497 Clock Tower in Piazza San Marco, Venice, Italy

The Duck of Jacques de Vaucanson, 1738





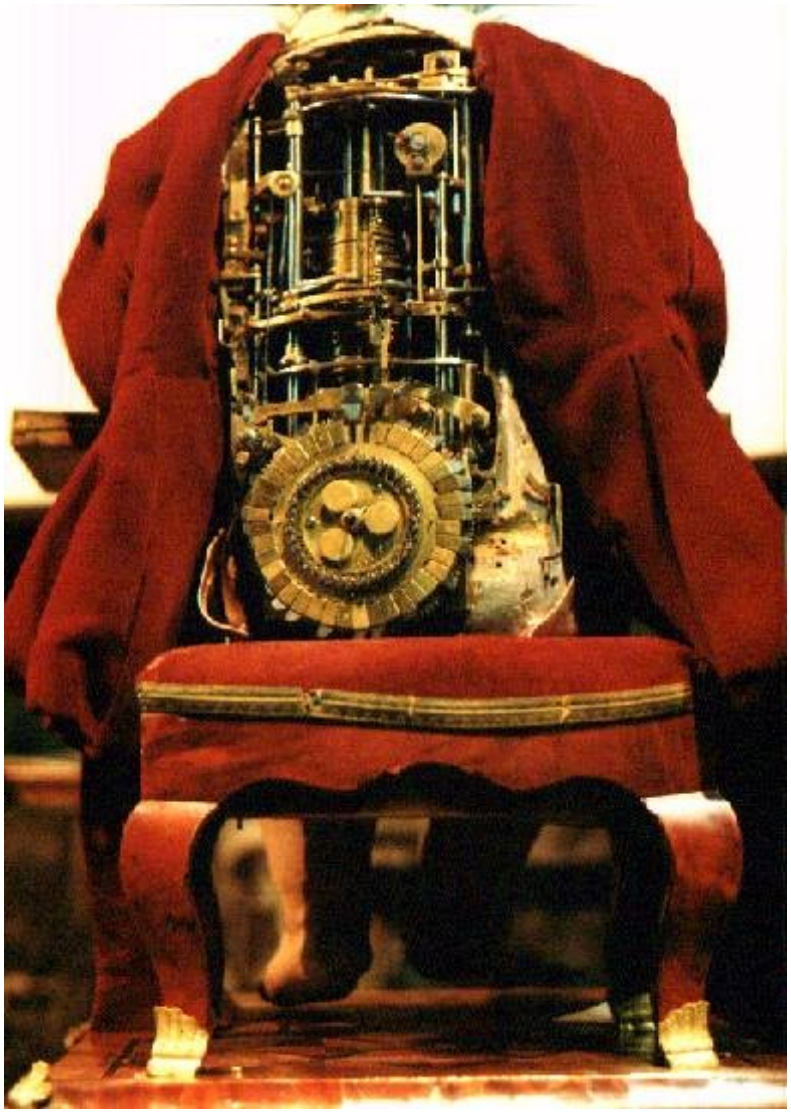


The Writer of Droz, 1774

Writer

Draughtsman

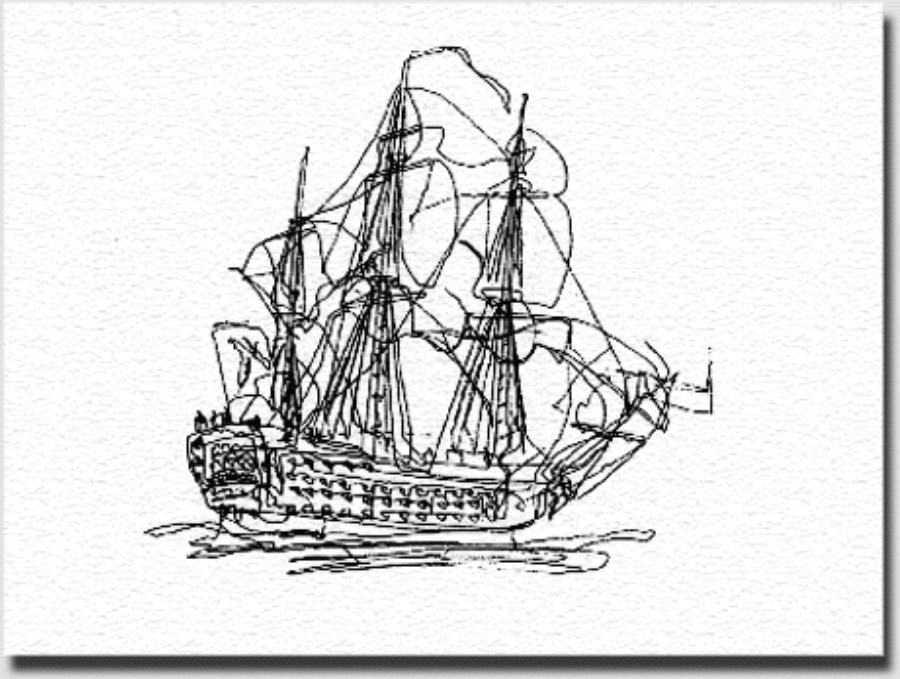
The Writer of Droz, 1774

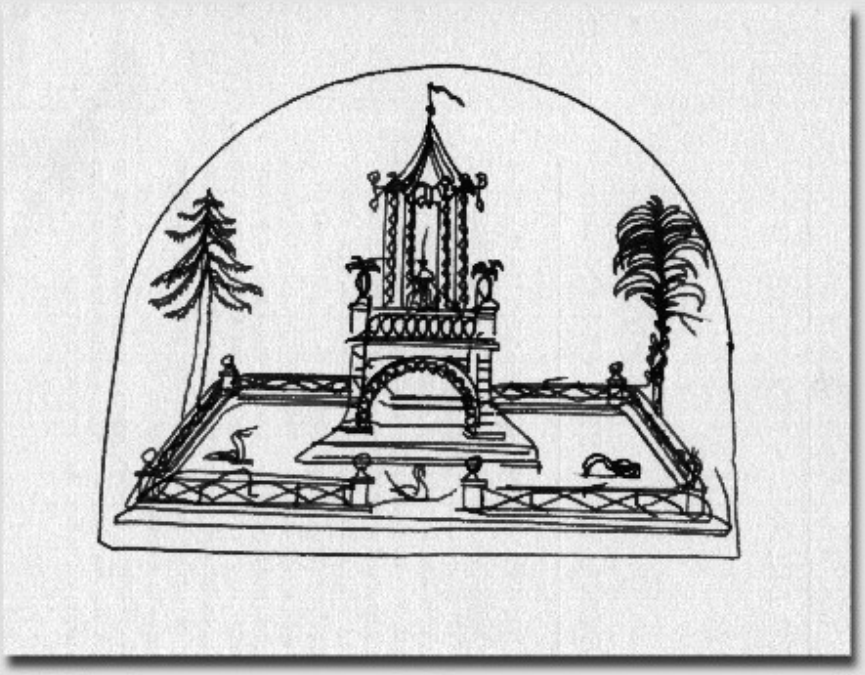


Maillardet, 1805

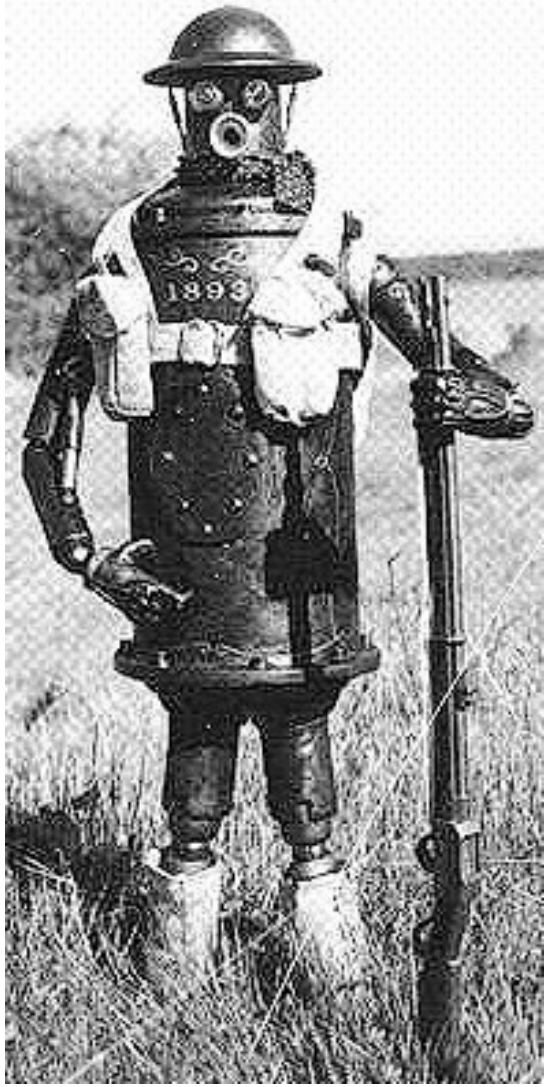
Maillardet, 1805

Maillardet, 1805



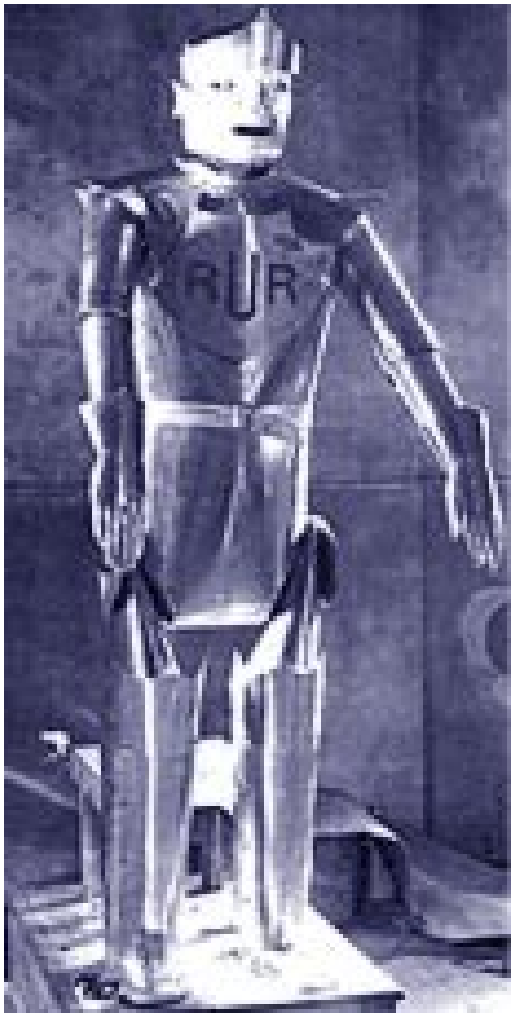


Boilerplate, 1893

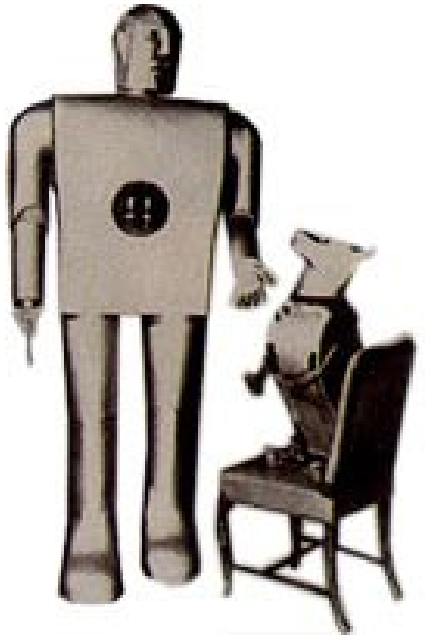


Boilerplate with Pancho Villa

Karel Čapek's R.U.R., 1920



Westinghouse’s Elektro, 1940



Isaac Asimov: *I, Robot*, 1942

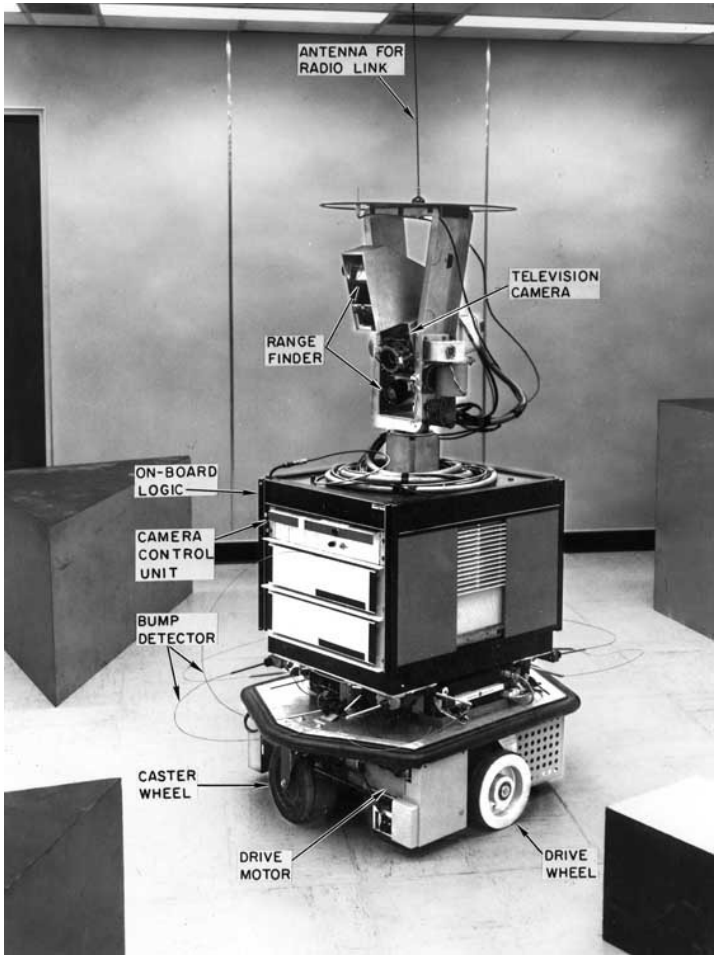
0. A robot may not injure humanity or, through inaction, allow humanity to come to harm. (This was added after the initial three laws in *Robots and Empire*)
1. A robot may not injure a human being, or, through inaction, allow a human being to come to harm.
2. A robot must obey the orders given it by human beings except where such orders would conflict with the First Law.
3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

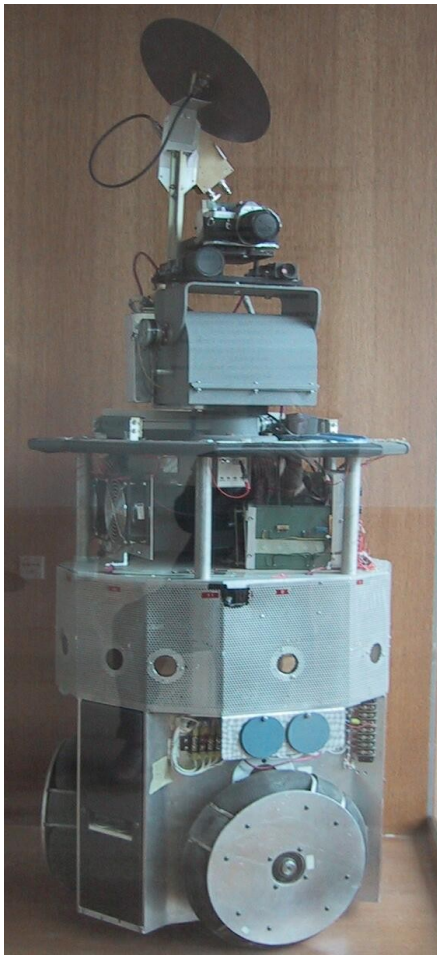
Handbook of Robotics,
56th Edition, 2058 A.D.

The story unfolds…

- **1954** George Devol designs first programmable robot and founds Unimation.
- **1959** Marvin Minsky /John McCarthy establish the AI Laboratory at MIT
- **1962** GM buys first robot from Unimation
- **1963** John McCarthy heads up the new AI lab at Stanford
- **1965** Carnegie Mellon University establishes Robotics Institute

Shakey (SRI, 1968) and Mobie (Stanford,?)



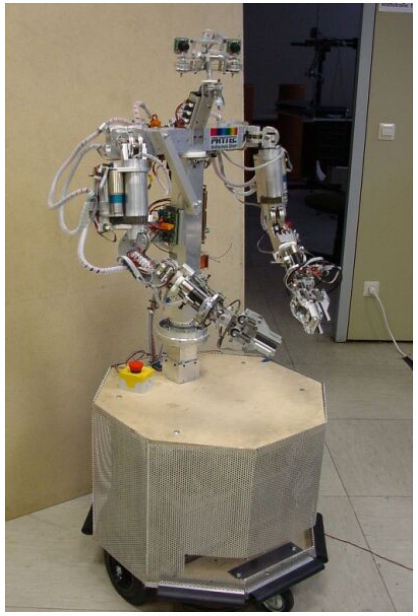


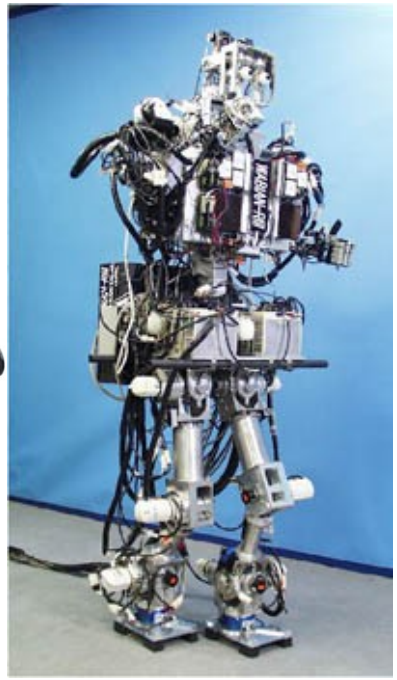
Stanford Scheinman Arm,1969

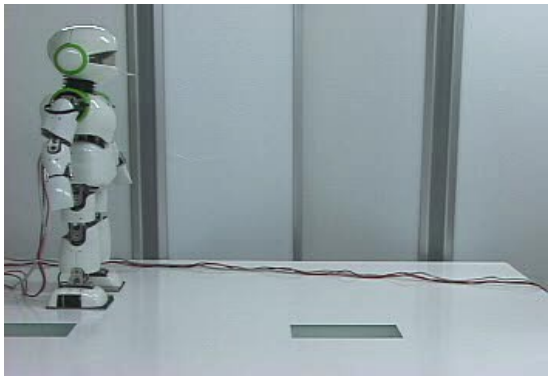
PUMA, 1978

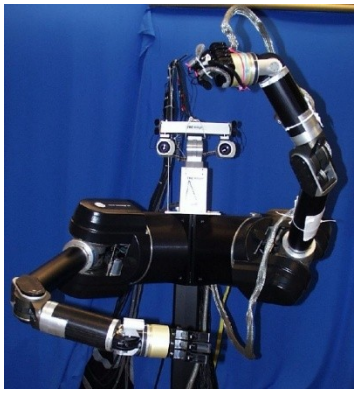
Unimation’s Programmable Universal Machine for Assembly

Today

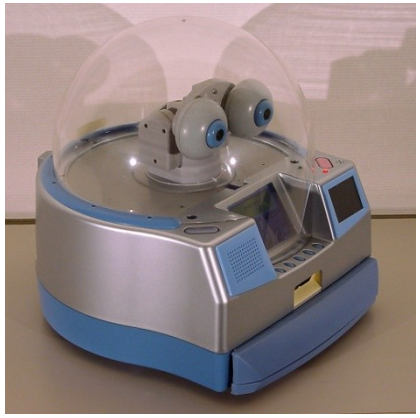




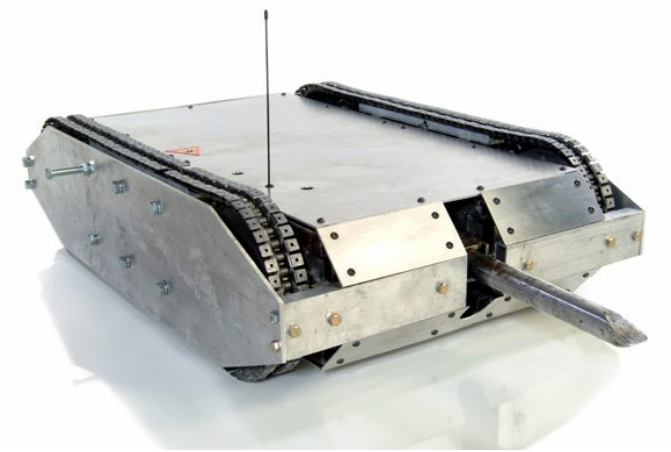


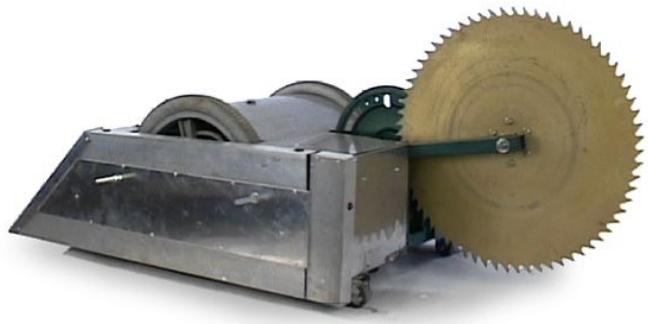


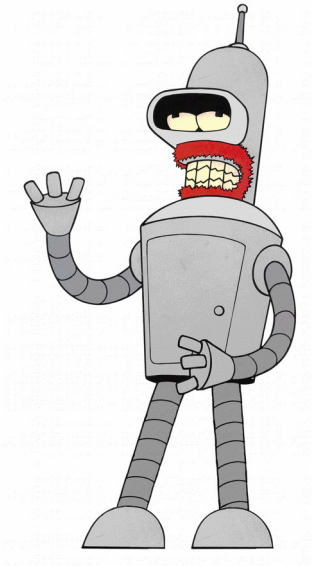
Industry

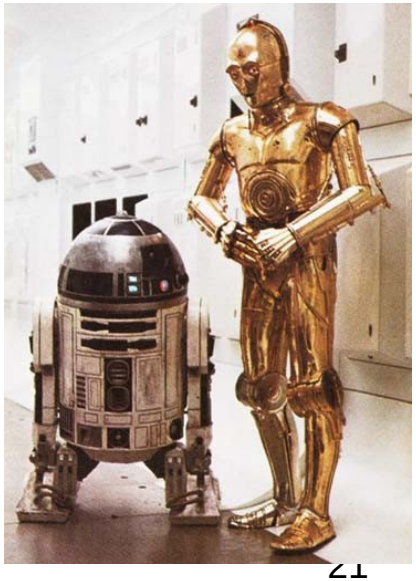


In people's minds?

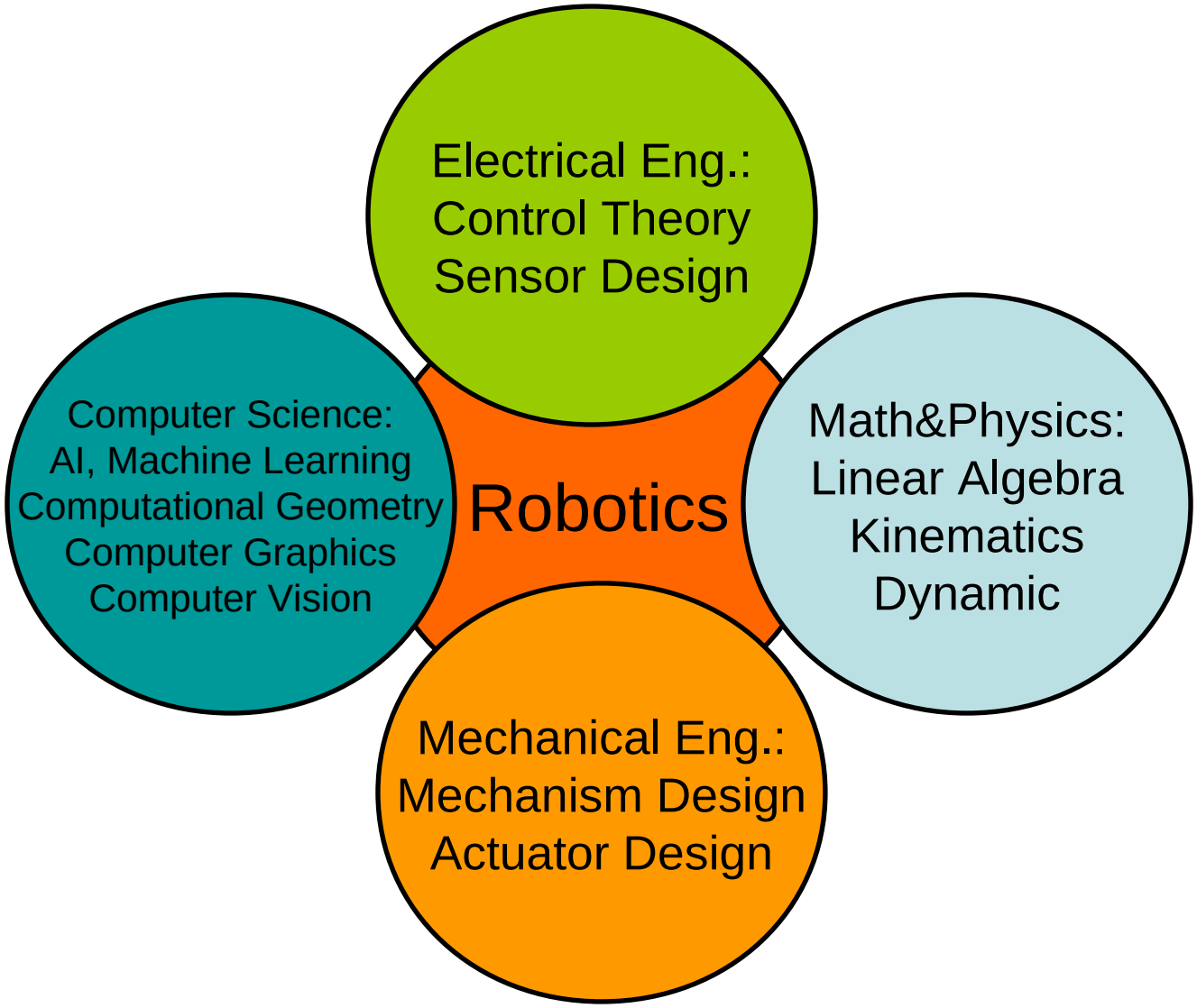




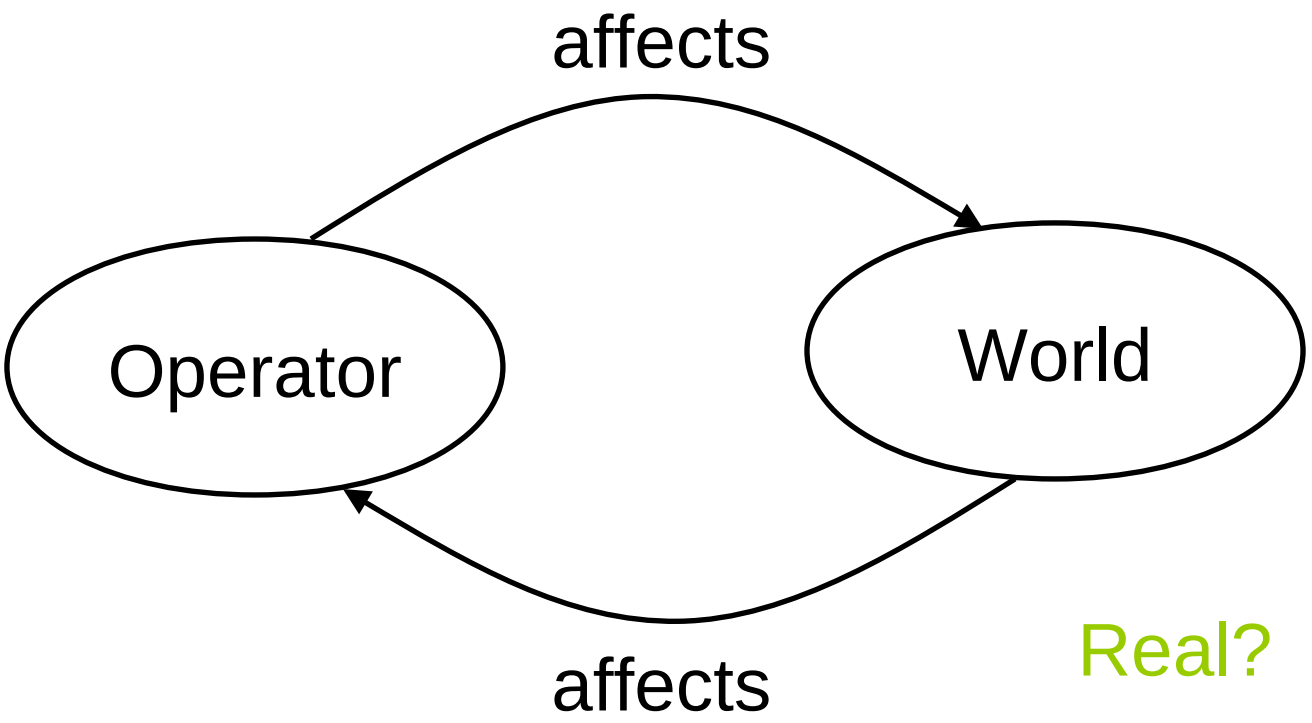




Robotics and its Neighbors



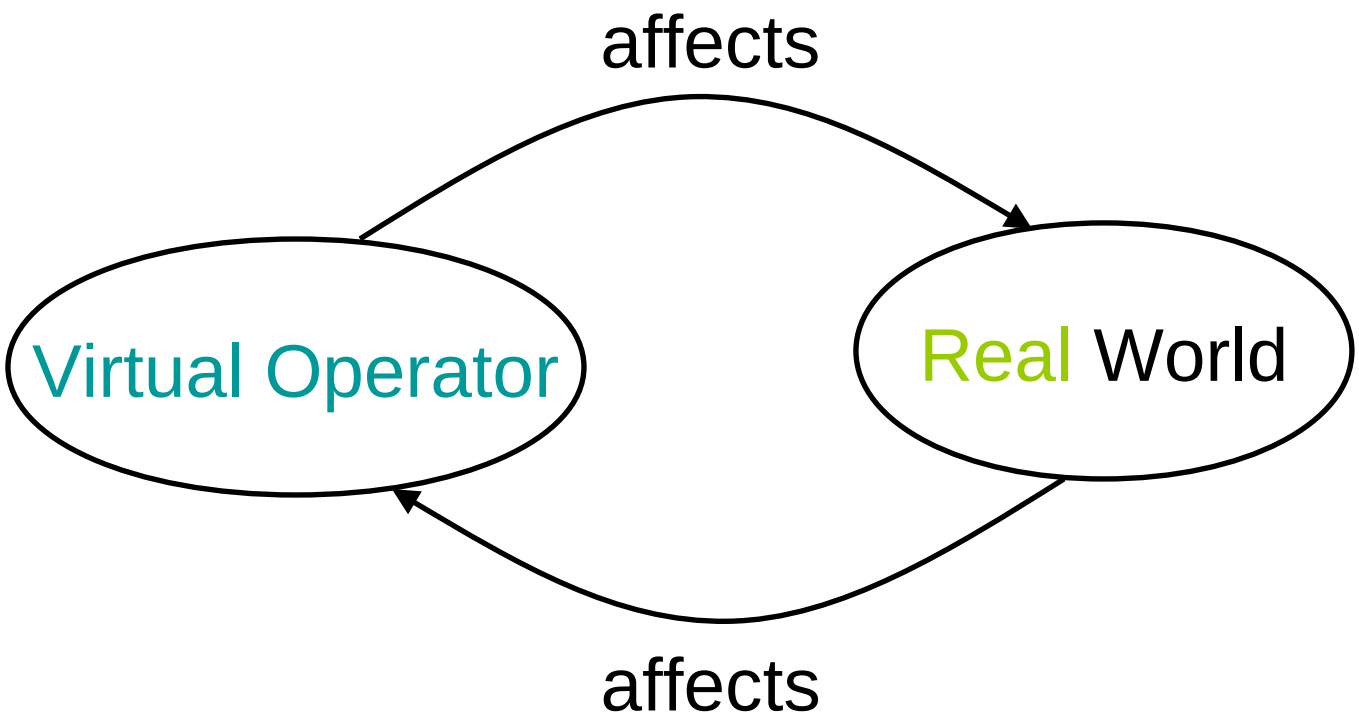
General Idea



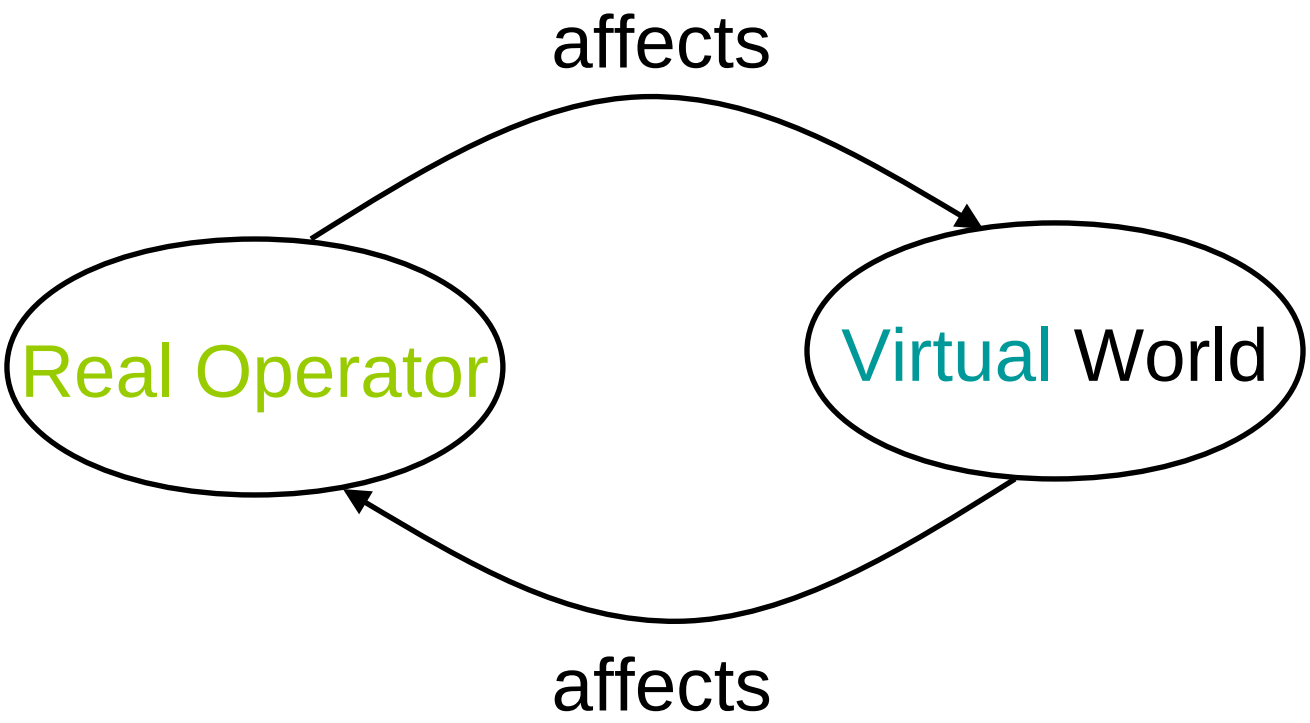
Real?

Virtual?

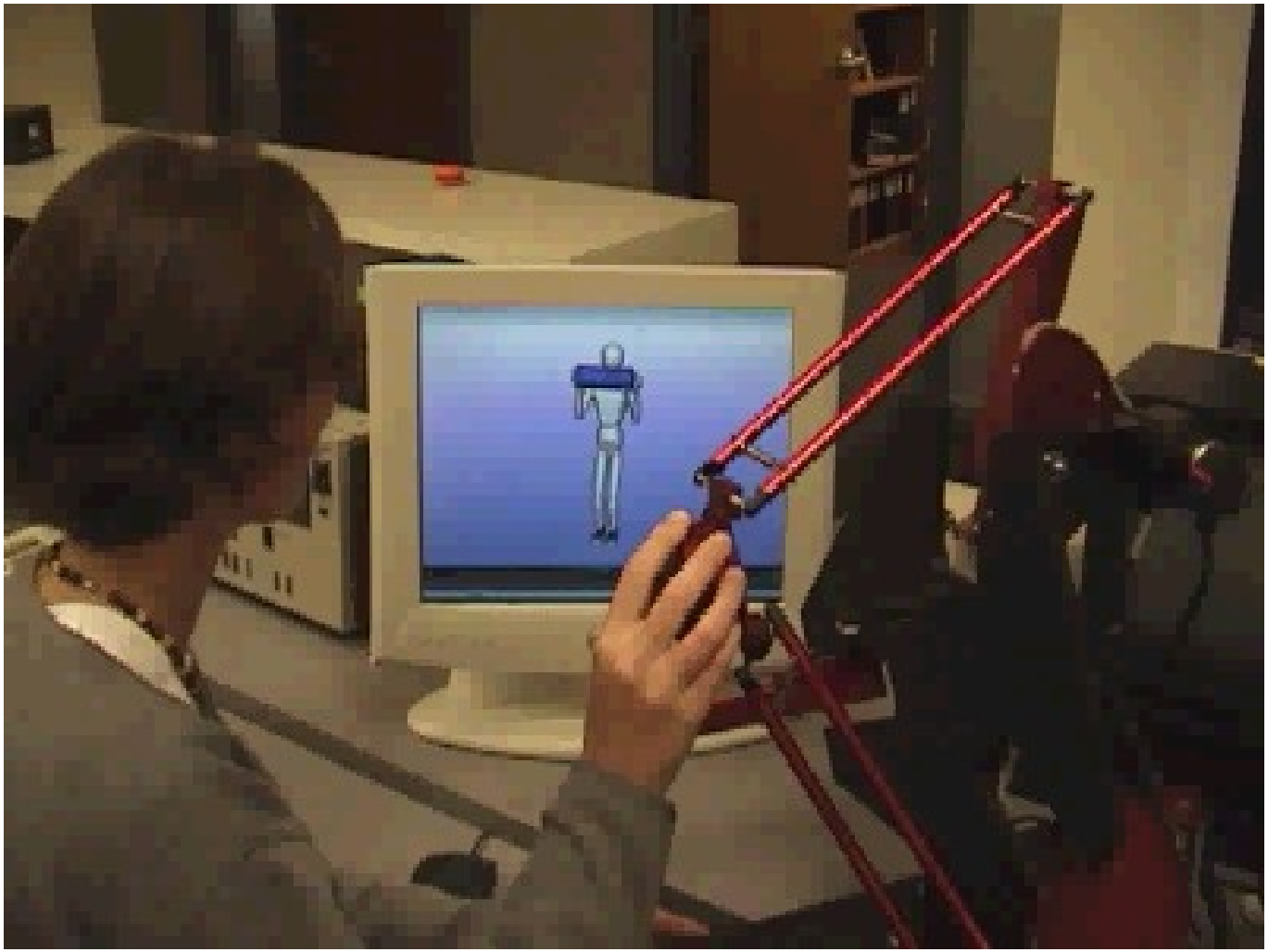
General Idea of Robotics



How about this?



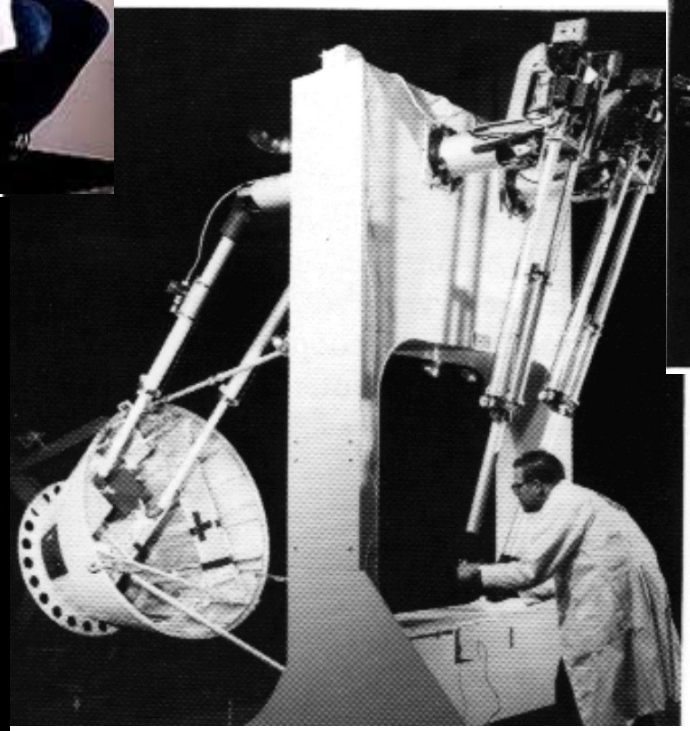
Haptics (Greek: haptesthai = to touch)

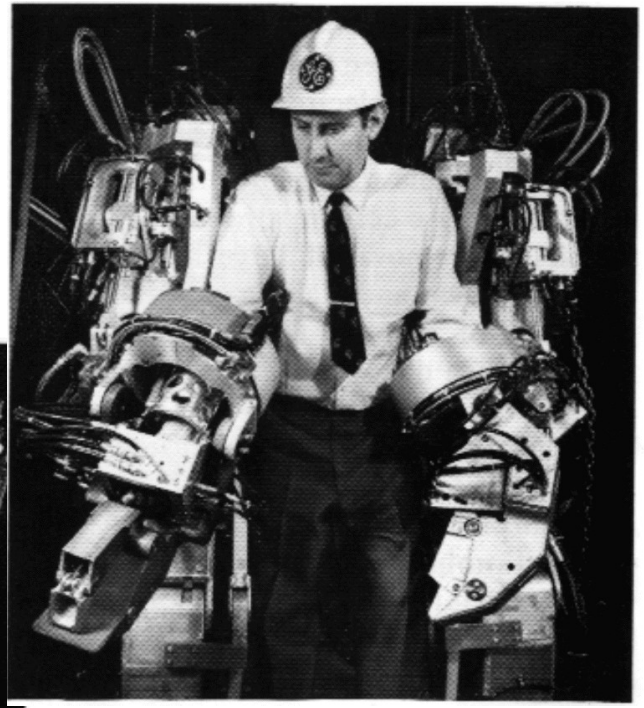


Real versus Virtual

World Operator	Real	Virtual
Real	Teleoperation	Haptics
Virtual	Robotics	Simulation

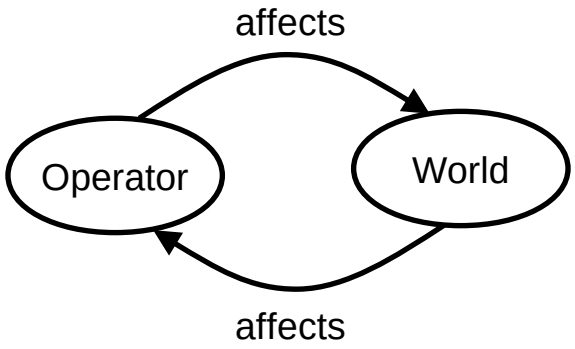
Teleoperation

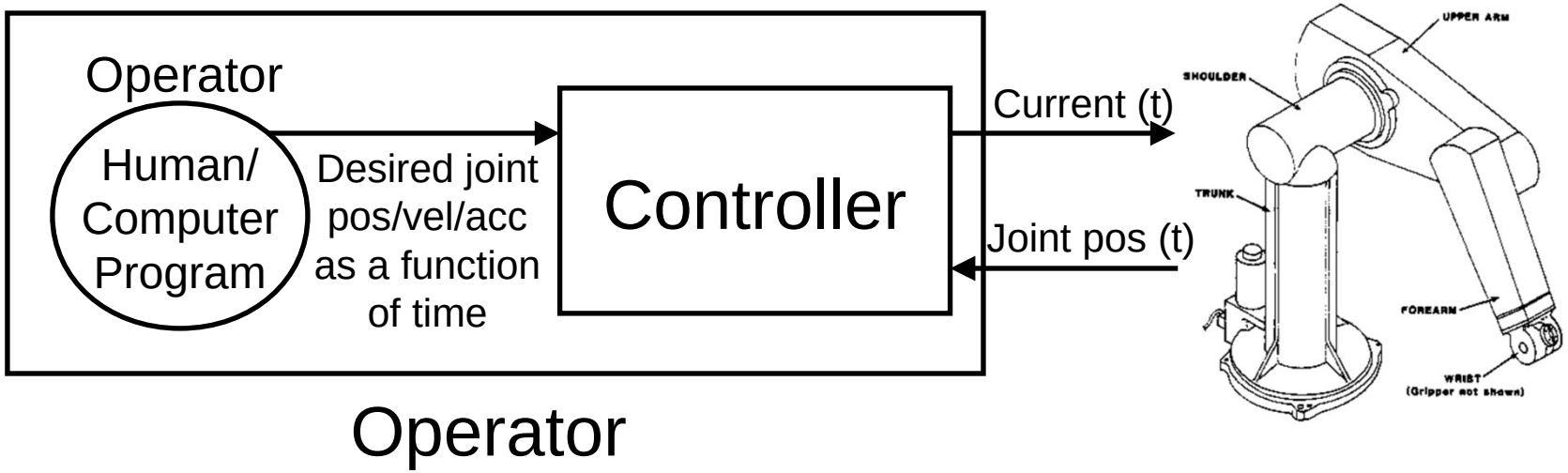




Dynamic Simulation

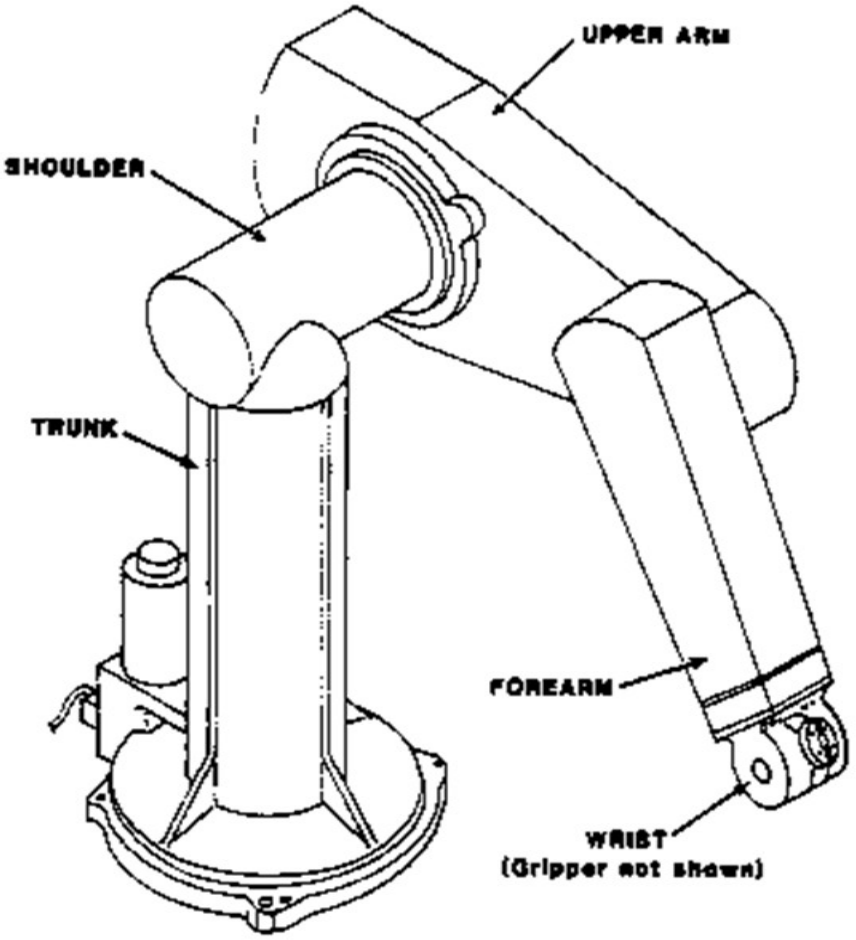
Underlying Building Blocks





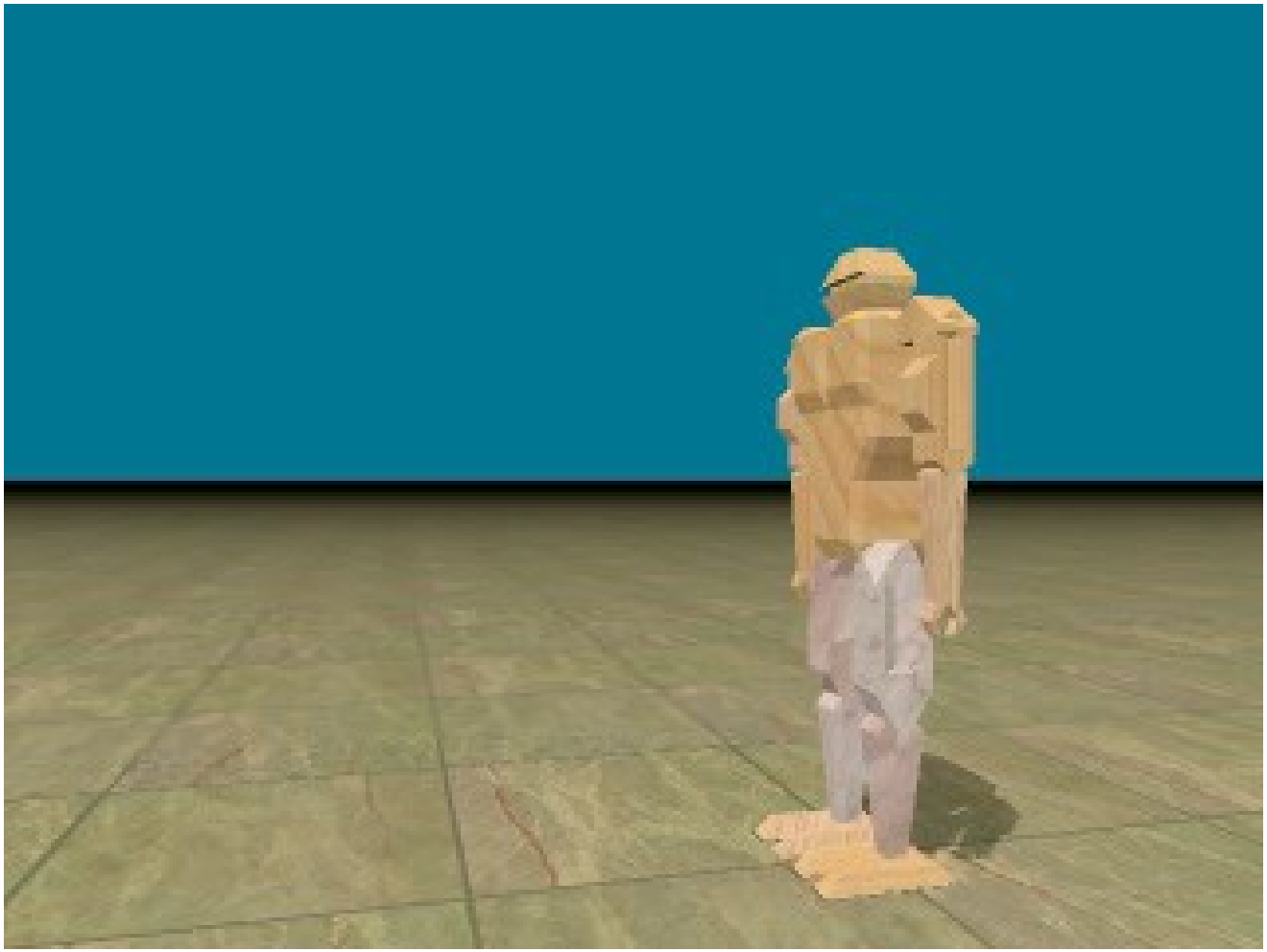
Operator

Making a Robot Move

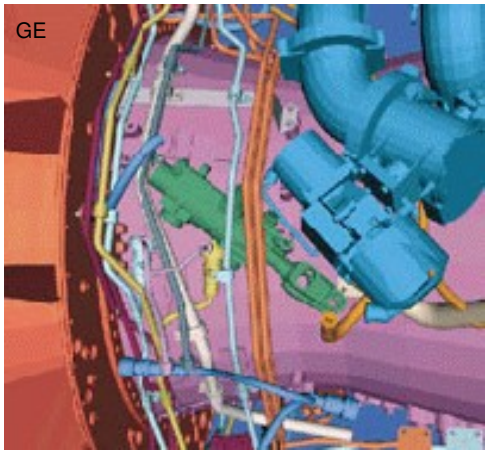


- Gravity
- Inertia
- Corilis and Centrifugal Forces
- Gear Ratio
- Gear Type
- Actuator
- Friction

Severe Consequences

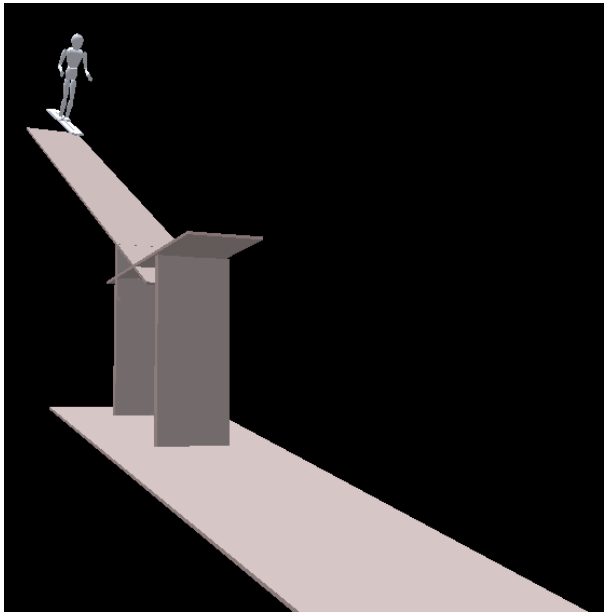


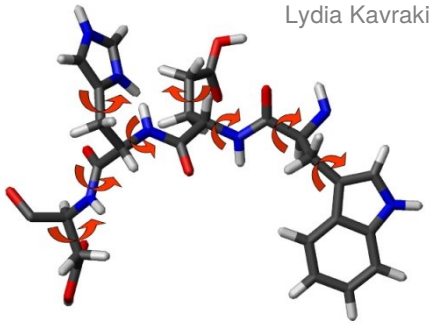
Applications of Robotic Techniques



Virtual Prototyping

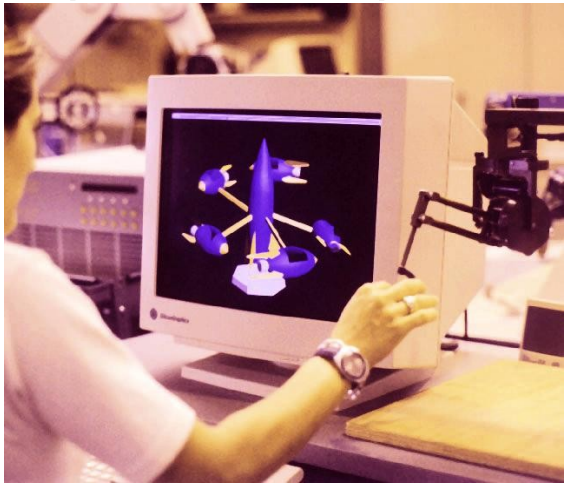
Dynamic Simulation





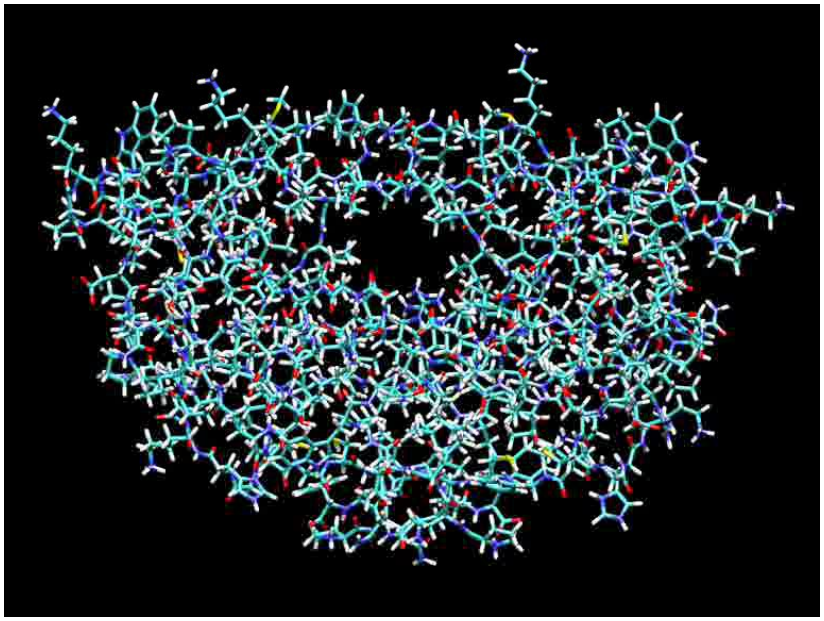
Molecular Biology

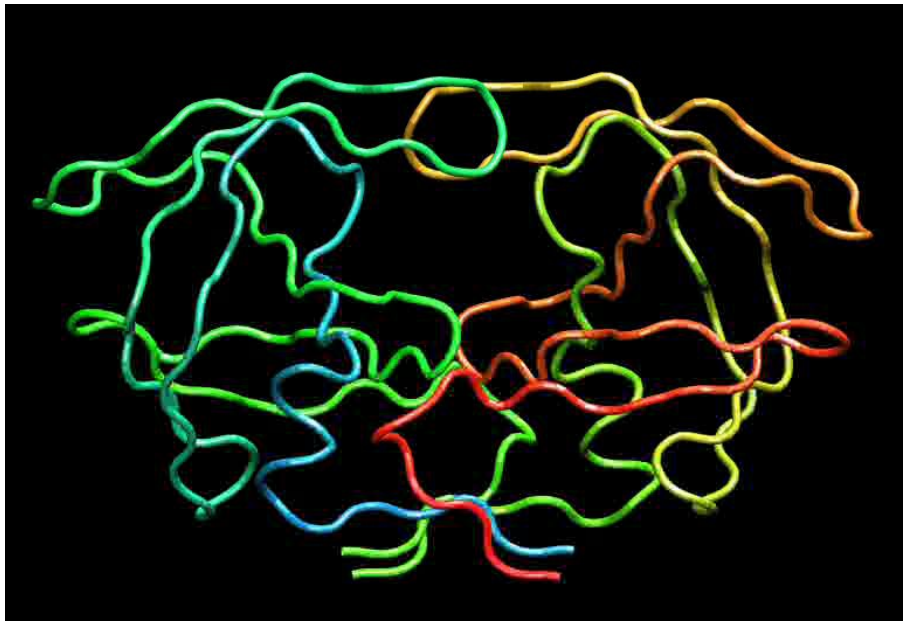
Haptics/Teleoperation



Character Animation
for Games and Movies

Structural Molecular Biology





Lydia Kavraki's research group

Biped Walking

Learning to walk

Real Walking

JOHNNIE

The TUM Biped Walking Robot

Technical University of Munich
Institute for Applied Mechanics
Prof. Dr.-Ing. Friedrich Pfeiffer

Design: M. Gienger
Control: K. Löffler