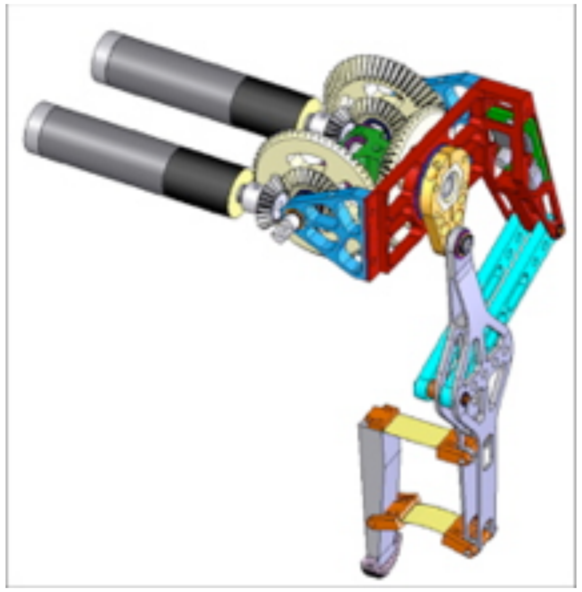
ME112: Mechanical Systems
Lecture 1, Jan 4 2016



- Course overview
- Introduction to the staff
- Logistics, schedules
- ME112 Canvas site
- Lectures, Labs, Videos, Projects..
- Preview of Assignment 1 and introduction to power flow in machines

Midterm Crawler Challenge: design a device using Lego kit + motor to meet a given challenge:

- Choose appropriate transmission parameters
- Analyze performance

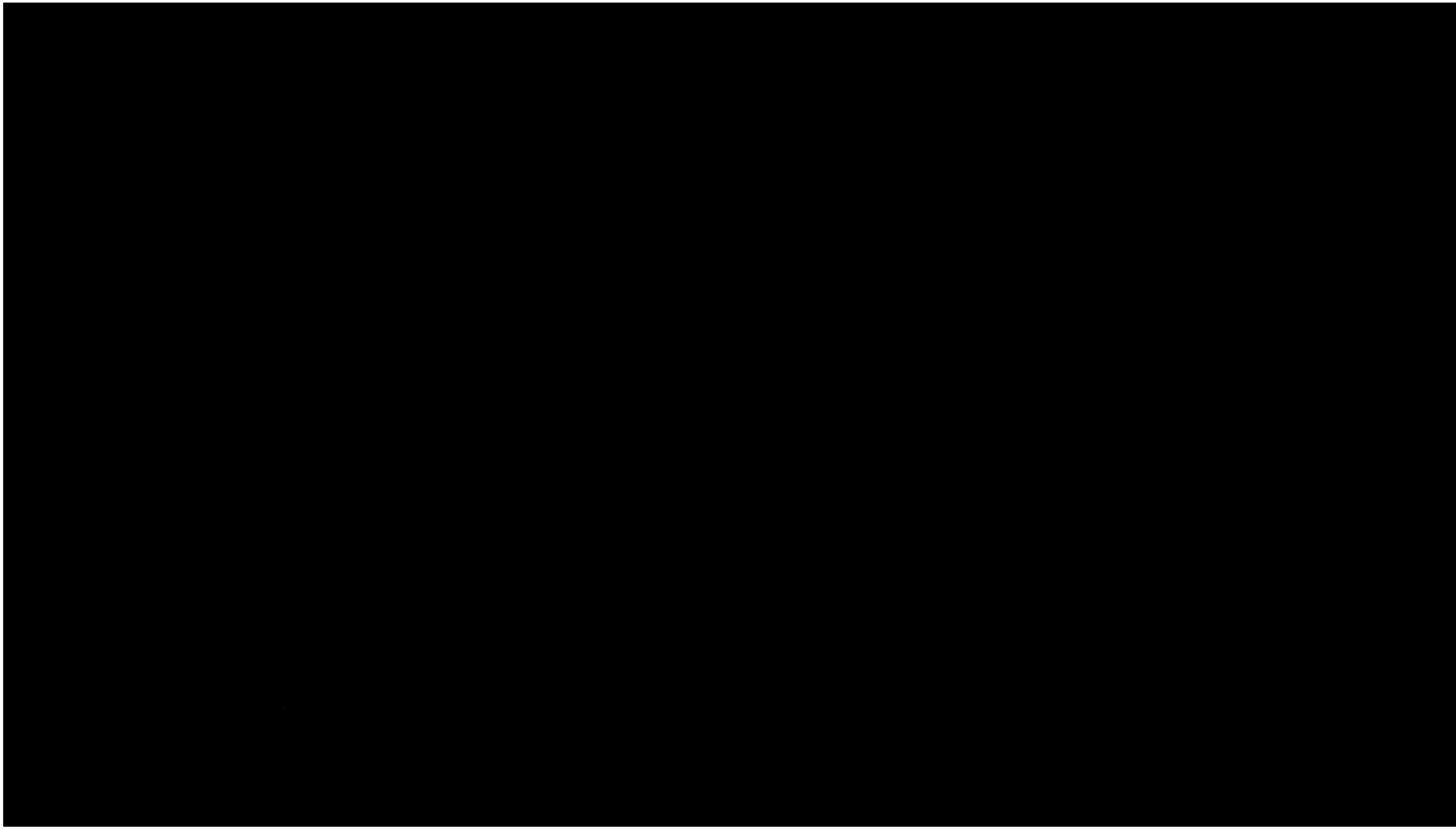
Help the park save its newest addition!

2015:

- Our Protoceratops has laid her first egg in a lava tube near the top of the park's volcano!
- It will surely die when it hatches unless you help us rescue the egg.
- The ideal solution would be a **stealthy device** that can be sent down the lava tube to grasp the egg and bring it back to safety

What new challenge will 2016 bring?

Video from 2013 midterm crawler challenge



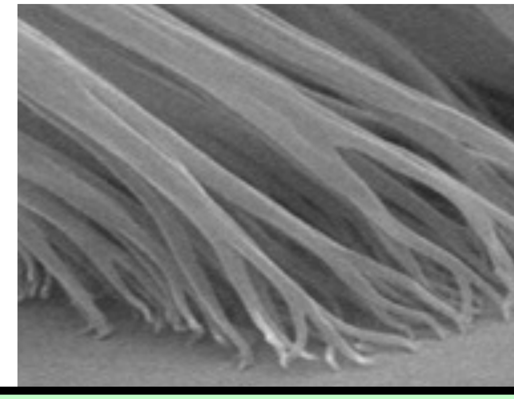
Final Design Project:

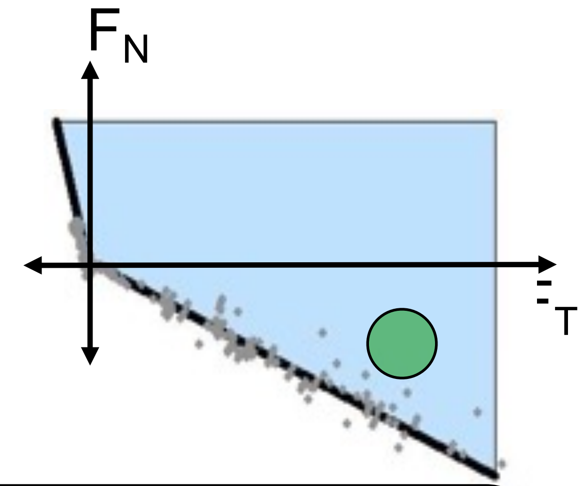
Design, construct and test a **bioinspired** [**?**] that meets a multifaceted challenge.

- Read background material for bio-inspiration
- Come up with multiple concepts
- Purchase and fabricate your own parts
- Employ linkages and transmissions
- Test and characterize performance
- Refine, iterate, tweak, refine some more…

Monitor team progress with multiple design reviews, intermediate documents, demonstration, final report

Bioinspired **feet** for **smooth climbing**



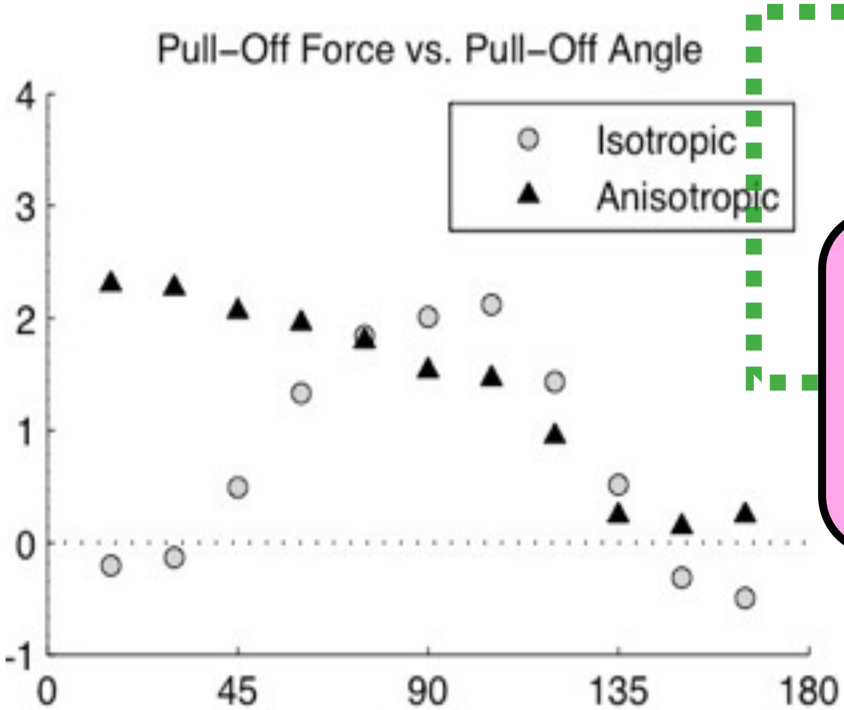


Bioinspiration
how do they do it?

Biology
examine literature, work with biologists

Hypotheses
regarding the principles at work

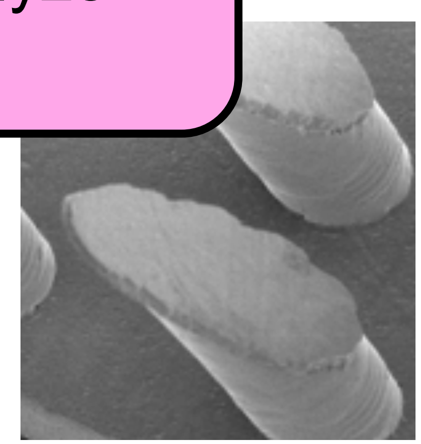
refinement

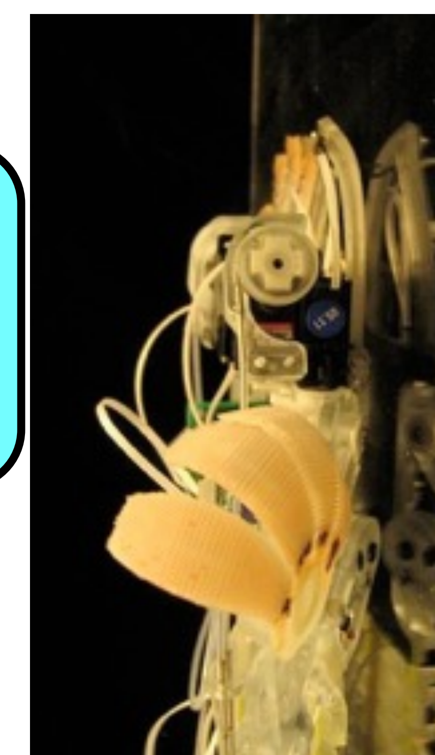


Analysis
test and analyze results

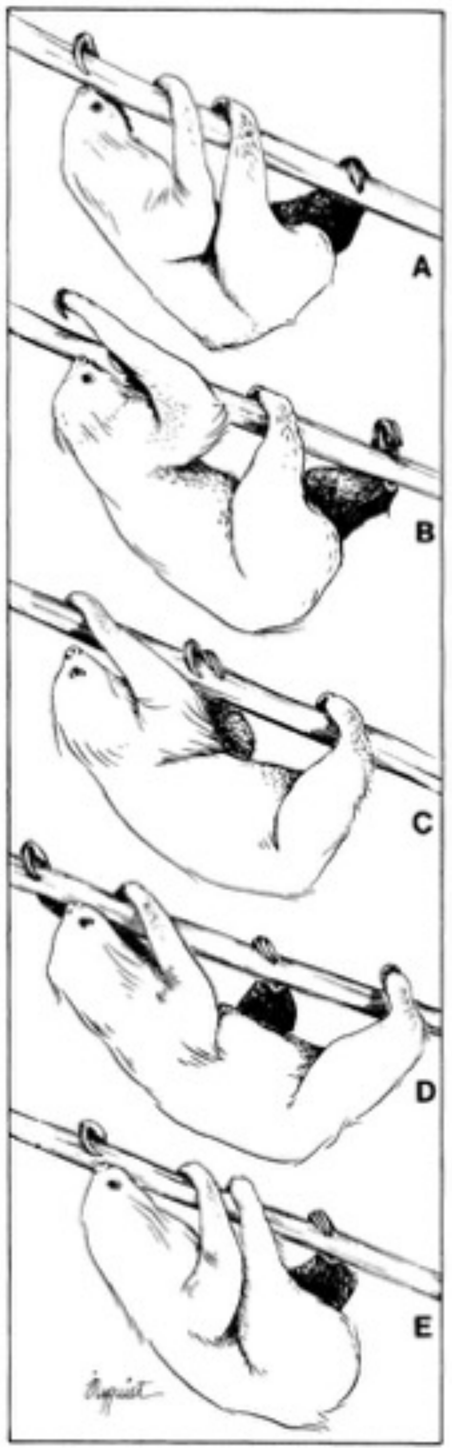
Robotics
implementations of principles

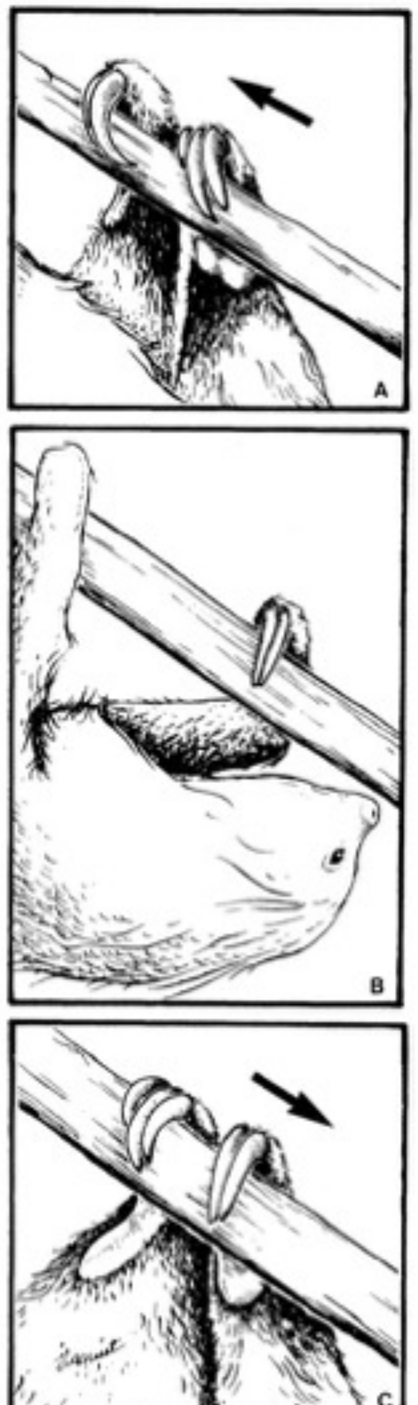
SDM technology

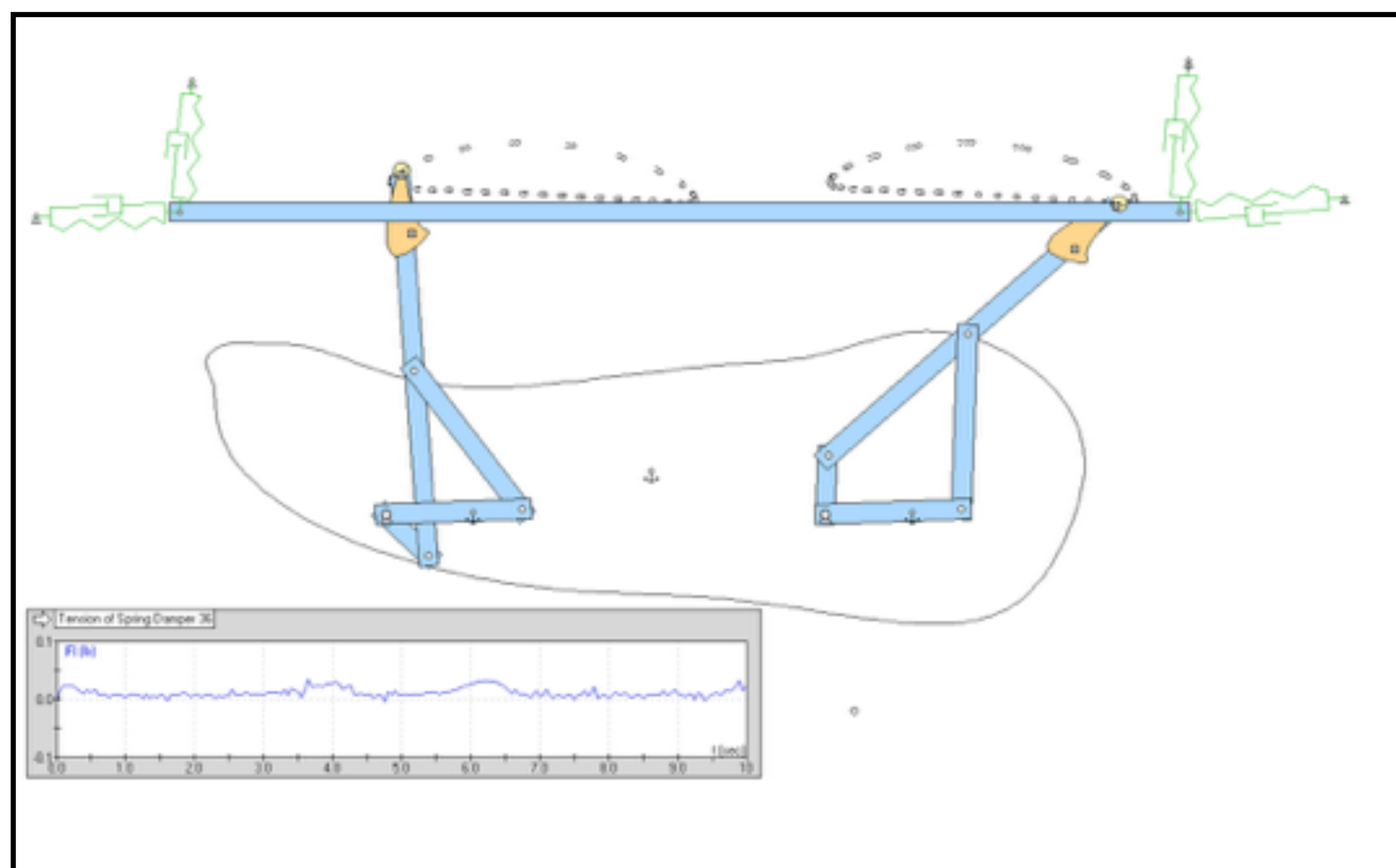




ME112 2011: Slothbots



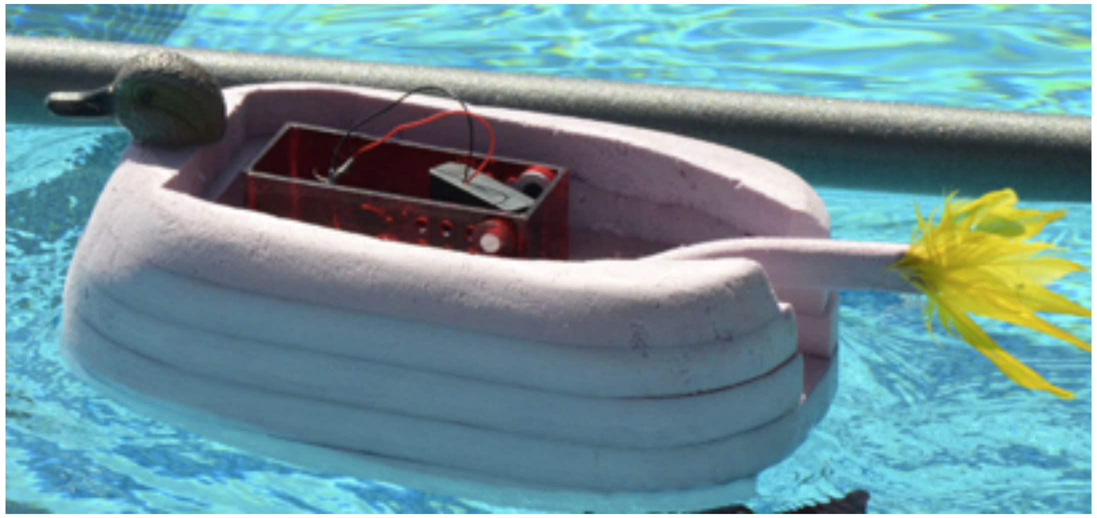




Slothbots in the New Guinea Sculpture Garden

Elephant seals

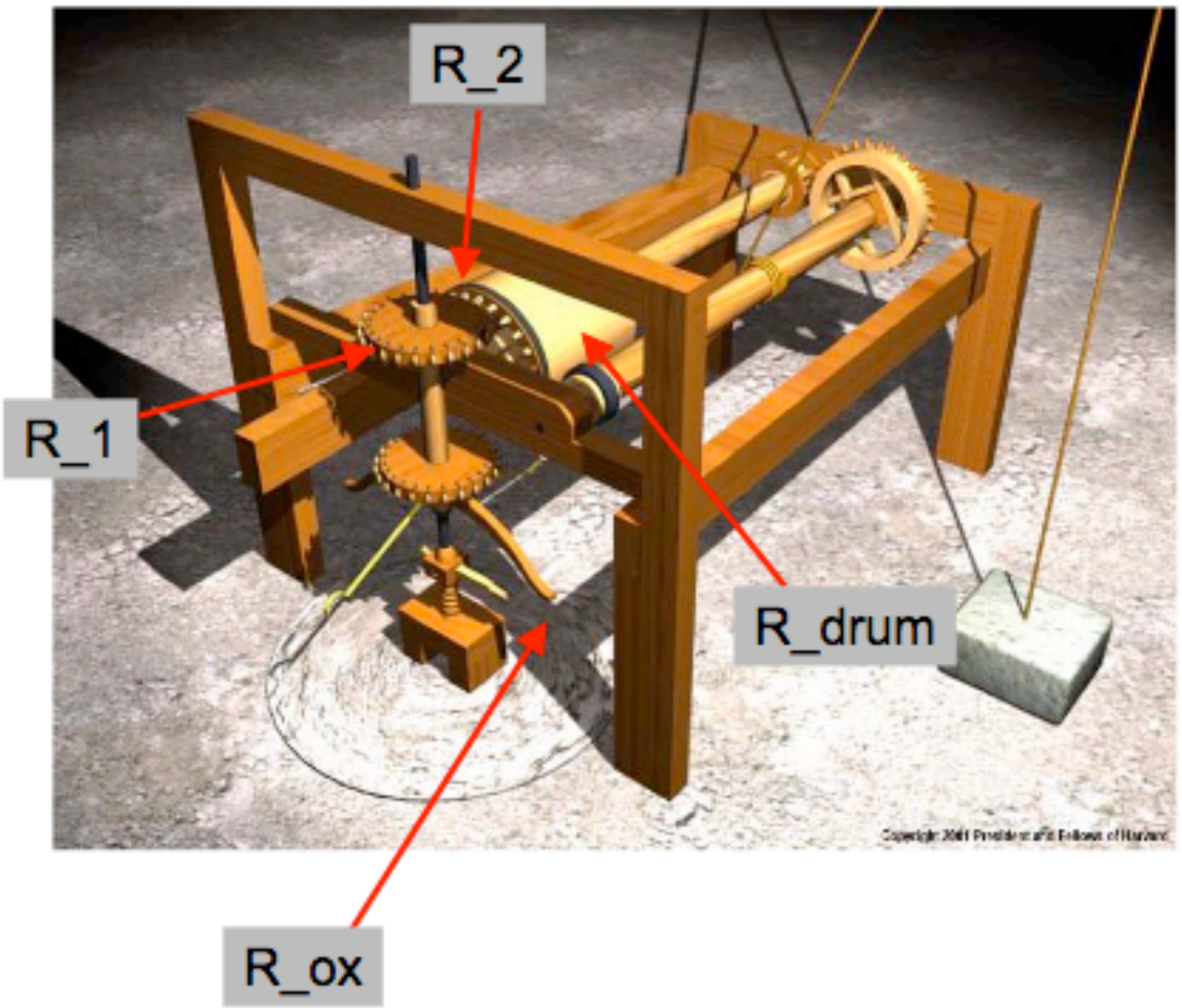
2014: If it swims like a duck…

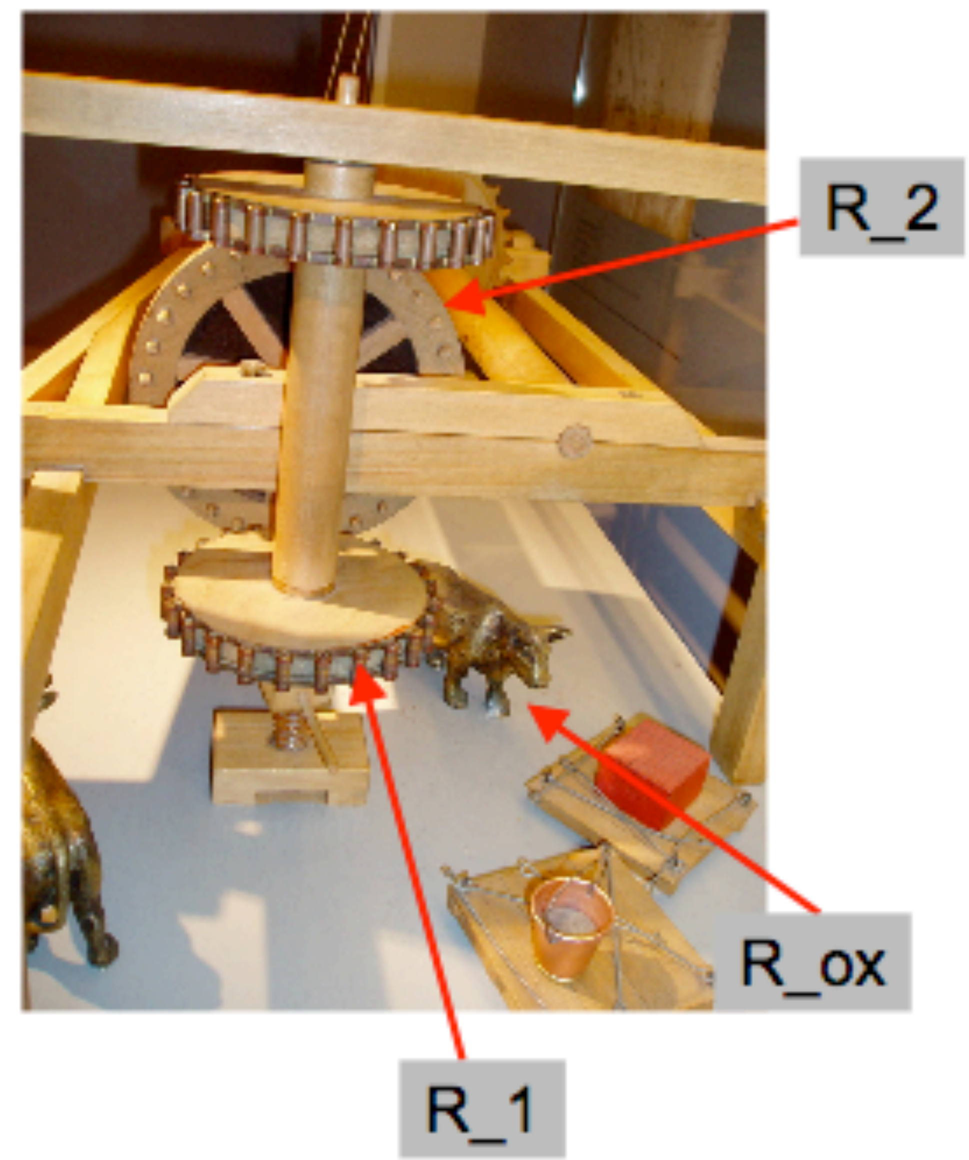


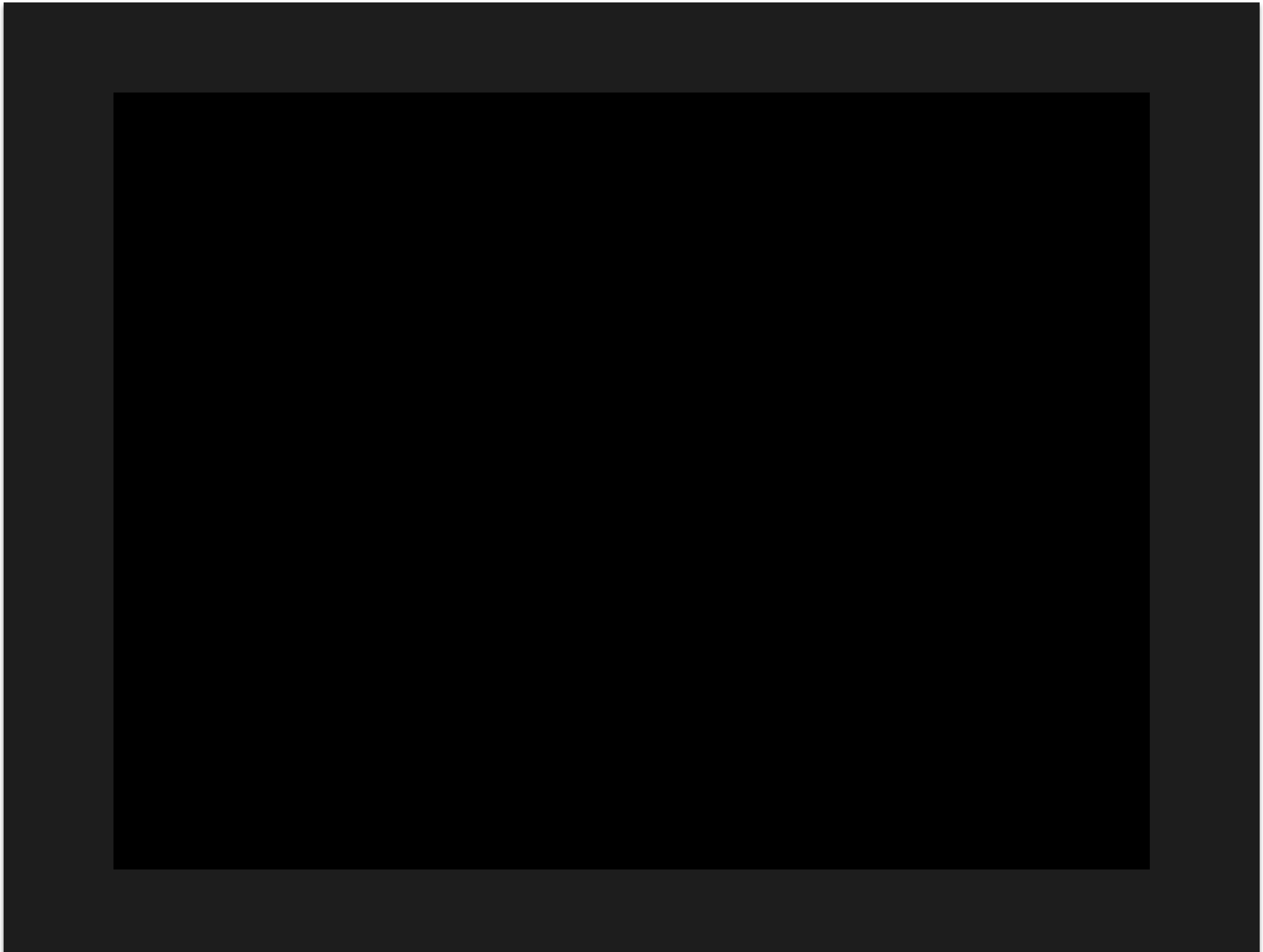
http://engineering.stanford.edu/news/animatronic-design-challenge-takes-water

Assignment 1: Read for Wednesday. Think of a couple good questions. We'll talk about it more. Answers due online by Friday

Example 1: Consider Brunelleschi's giant 3-speed reversing hoist as an example of an input/output system – the same machine used in Assignment 1.







Excerpts from: *Medici, Godfathers of the Renaissance,* PBS

(can download as a videoclip, *Brunelleschi's Machine,* from: http://bdml.stanford.edu/Main/BrunelleschiNotes)

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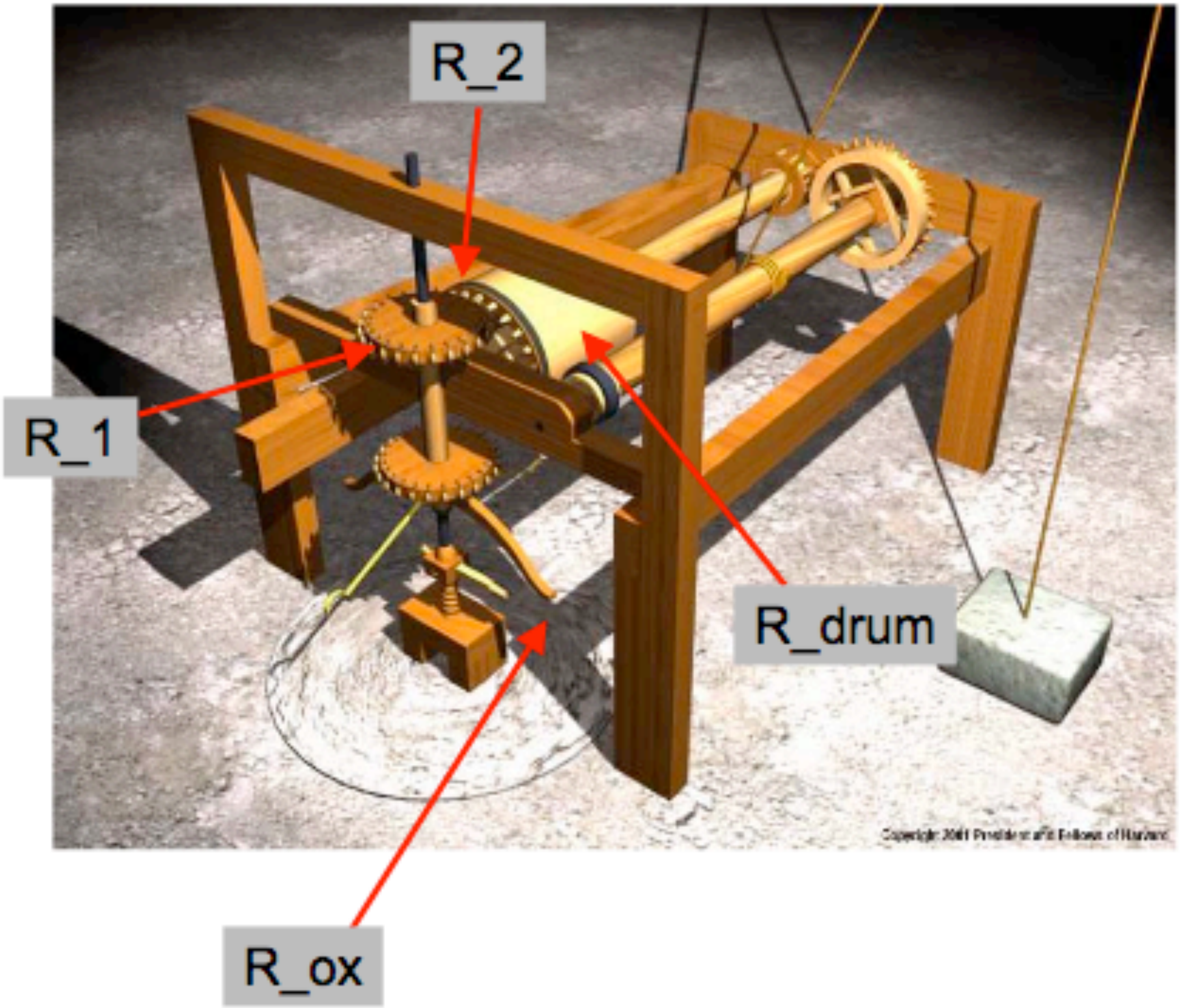
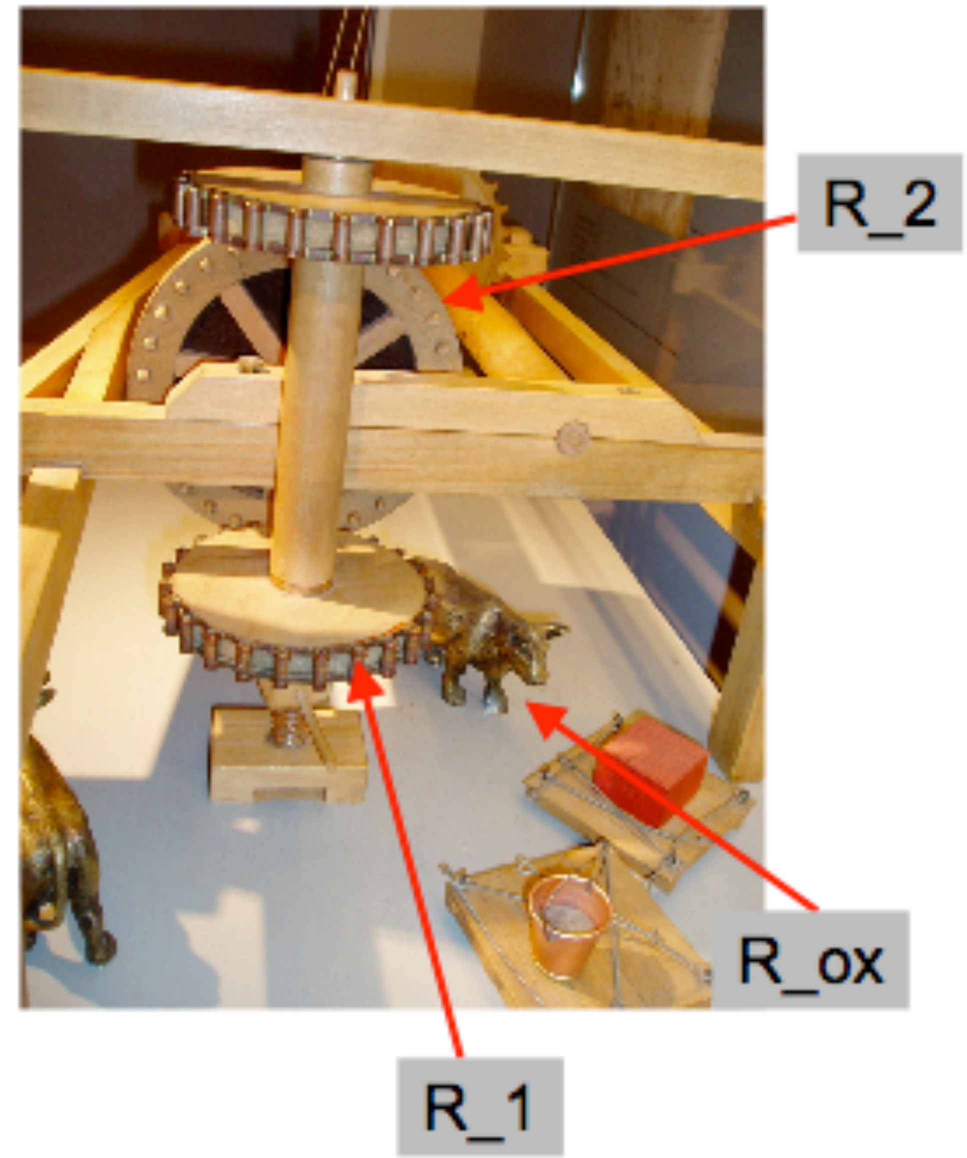




Links to background material and videos:
http://bdml.stanford.edu/Main/BrunelleschiNotes

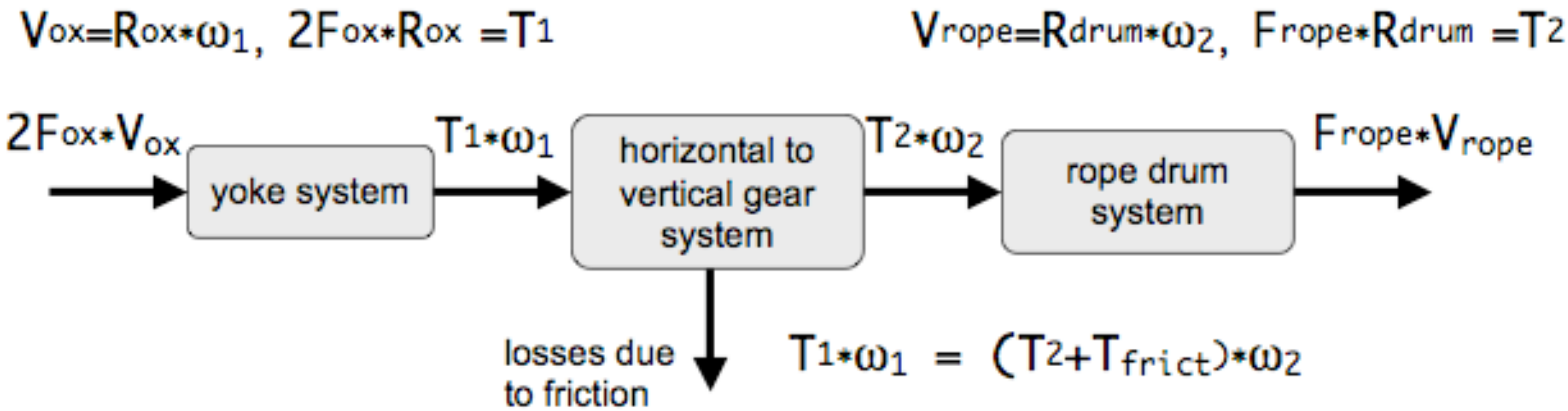
At what speed could we get the most productivity?

For a given speed ratio, what's the heaviest block we could lift?

power = force · velocity

(or torque · angular velocity)

Visualize the **power flow** in a machine as a block diagram:



Fox = Ox force (varies with speed)

Vox = Ox speed

T_1 = torque on vertical shaft from the 2 oxen

T_2 = torque on horizontal shaft

ω_1= angular speed of vertical shaft (rad/sec)

ω_2= angular speed of horizontal shaft (rad/sec)

Vrope = speed of rope

Frope = force on the rope

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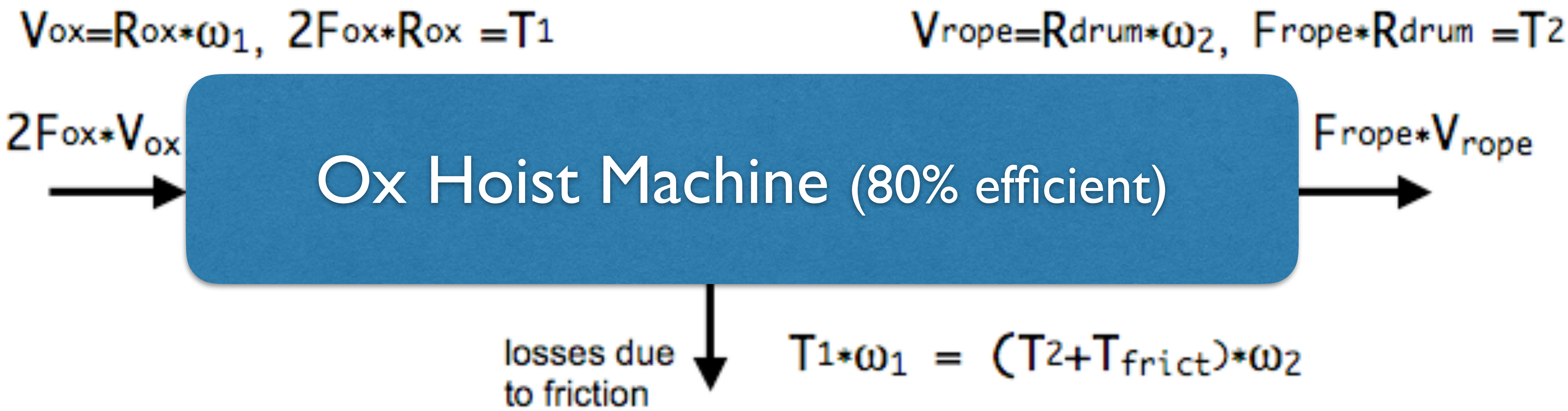

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☑ At what speed could we get the most productivity?

☑ For a given speed ratio, what's the heaviest block we could lift?

For Wednesday, please:

- Read over Assignment 1.pdf online; think of a good question.
- Watch short video "Gears1: serial and compound gear trains"

  (suggest viewing speed = 1.5x)
- Sign up for Transmission Lab (signup opens 12:00 Tues)