

Automata: Putting it all together

# Tentative Schedule

18:00 Guest Lecture

18:30 Lab “Putting it All Together”: Automata example (The Gymnast)

19:15 Project Time: Form (2-3 person) team; Automata sites and concept sketches

20:00 Email Team Proposal (3-slides: inspirational video and sketches)

20:15 Clean up and Adjourn

# Review

## Lab 1: Simple Machine I: Levers, Shafts, And Cranks

### Hands-on Lab

- Simple Crank
- Crank 3-bar
- Crankshaft
- Complex Crank

### Homework

- Constructed slider-crank mechanism

## Lab 2: Simple Machine II: Cams, Springs, And Linkages

### Hands-on Lab

- Cam Follower
- Cam Follower Vehicle
- Torsional Linkage
- Multi-jointed Torsional Linkage
- 4-bar linkage walker

### Homework

- Flat folding chair

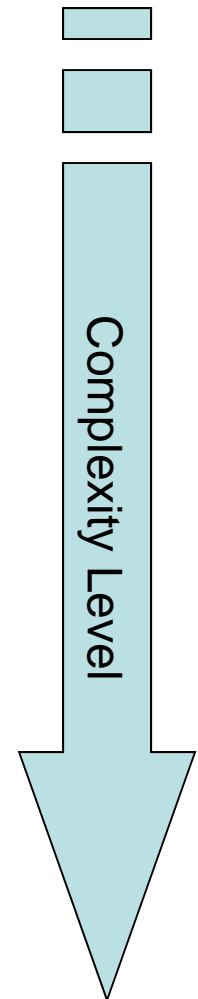
## Lab 3: Simple Machine III: Ratchets, Drives, And Gearing

### Hands-on Lab

- Planetary Gears
- Bevel Gears (and Pin Wheel)
- Worm Gears
- Rack-and-Pinion

### Homework

- Windshield Wiper

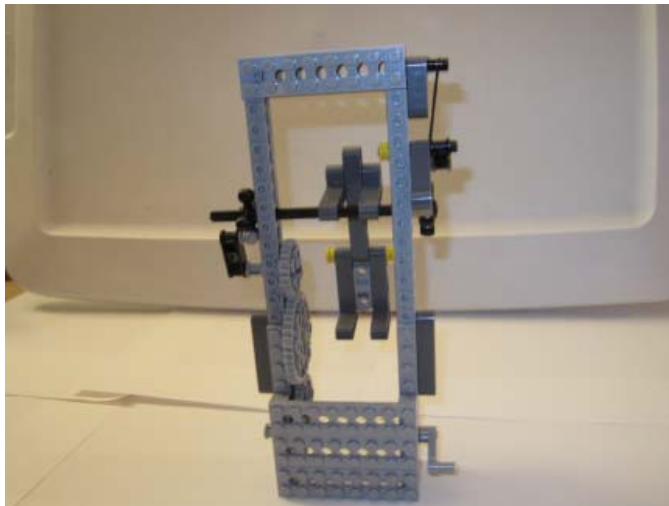


Result is a cookbook with fundamental recipes. Now, you can create a meal

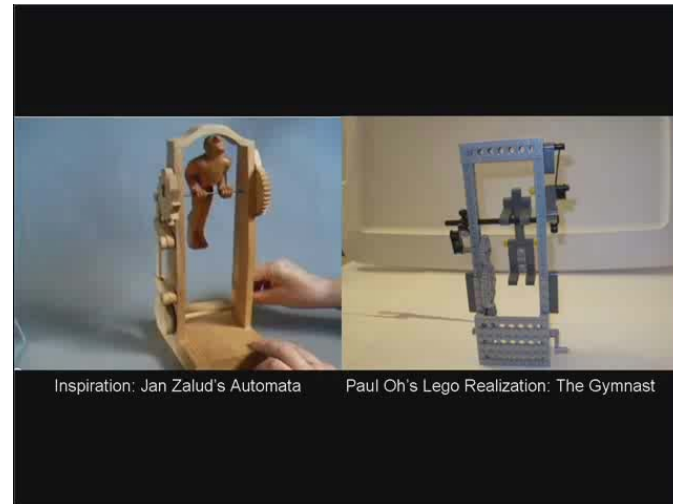


- Input: handle crank (Lab 1)
- Cam and follower (Lab 2)
- Follower pushes ratchet (Lab 3)
- Conversion of translation to stepped rotation
- Detent prevents ratchet 2 from reversing
- Output: multi-link figure rotates

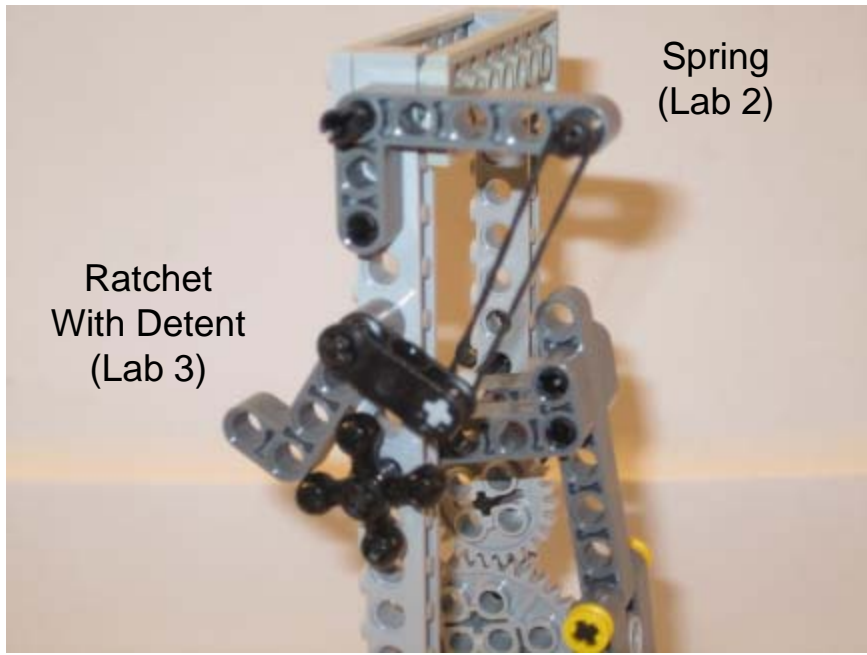
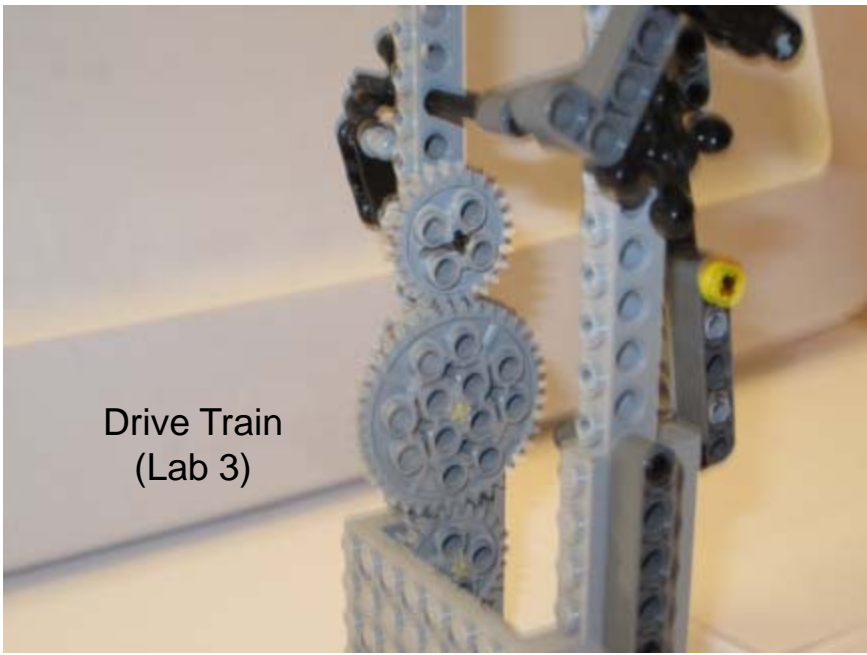
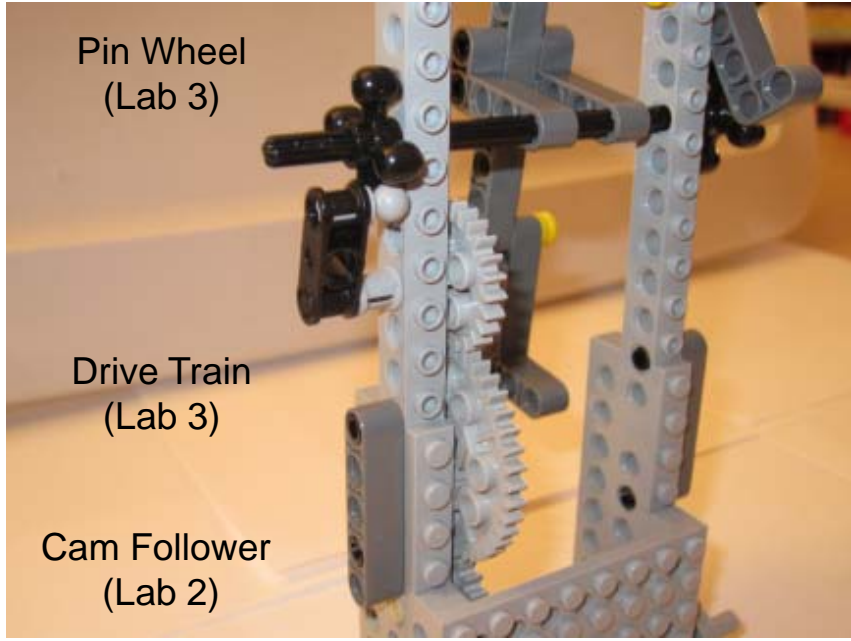
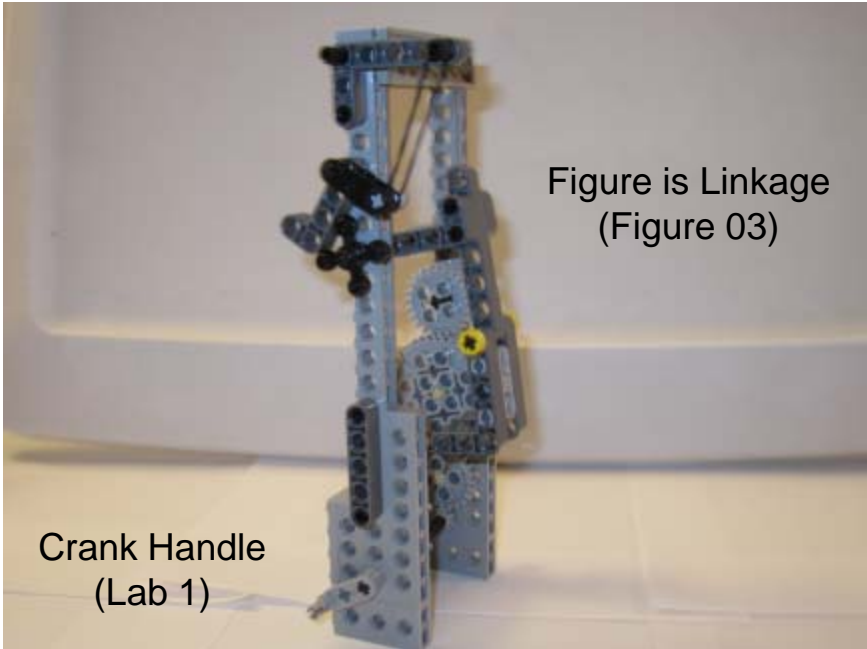
[http://www.youtube.com/watch?v=zy5B\\_bzNID4](http://www.youtube.com/watch?v=zy5B_bzNID4)



LEGO-based Automata – The Gymnast

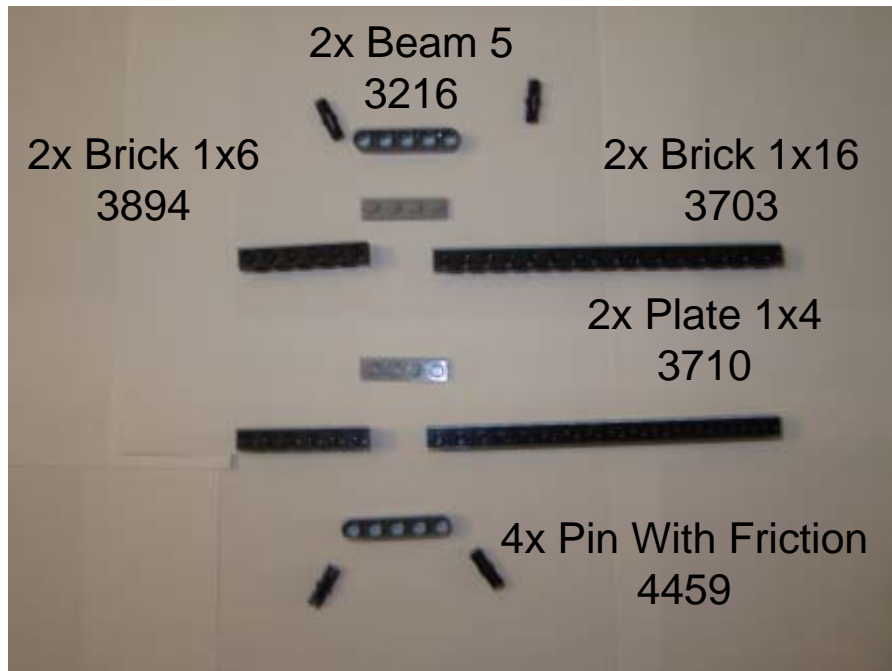


Video



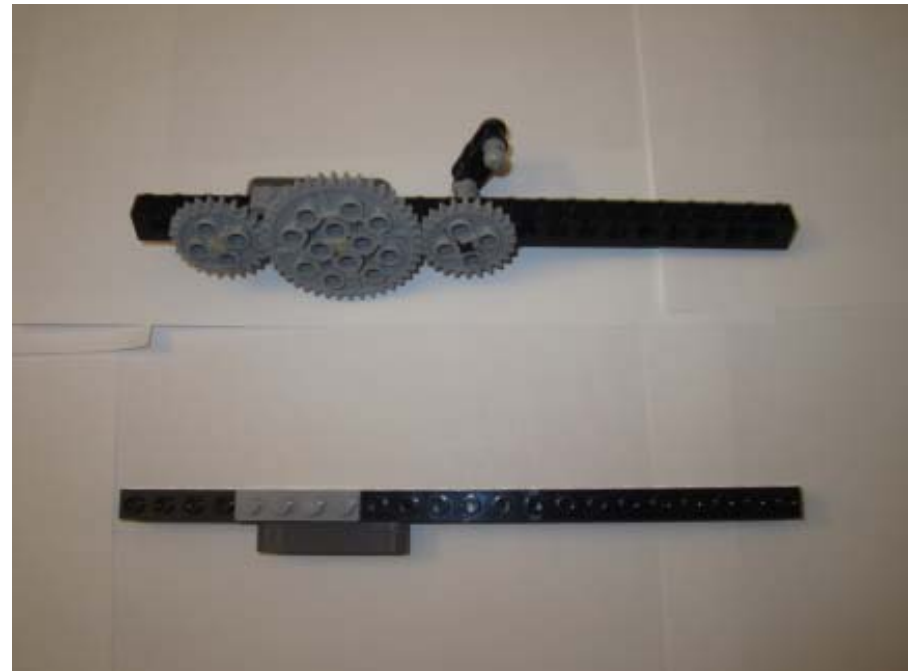
# Lego-Based Automata: The Gymnast

## Step 1: Assemble rails



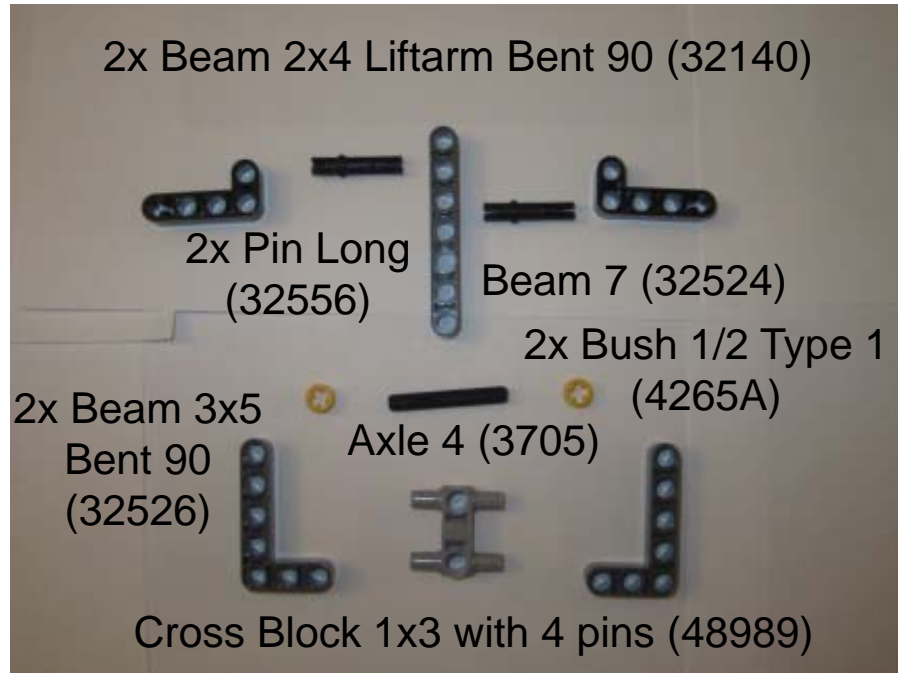
Connect the 2 bricks with a plate. Secure connection with a beam. Construct 2 of these

## Step 2: Assembly Gear Train



Align and insert first 24T Gear. Mesh and insert 40T Gear. Align second 24T gear and thread Axle-5. Secure with bush and attached cross block. Insert Axle Towball in cross block

### Step 3: Construct the gymnast figure

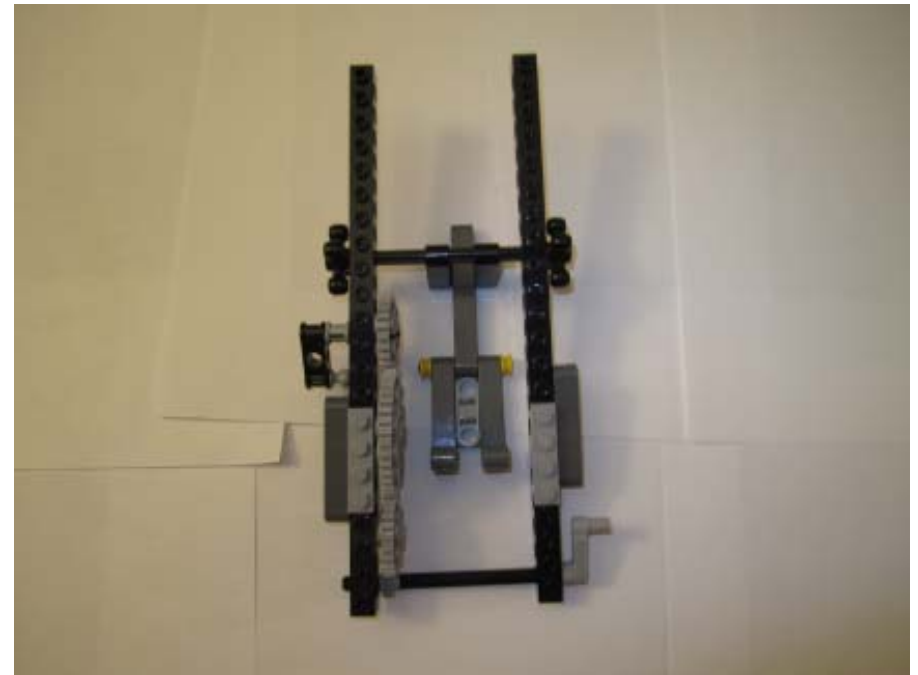
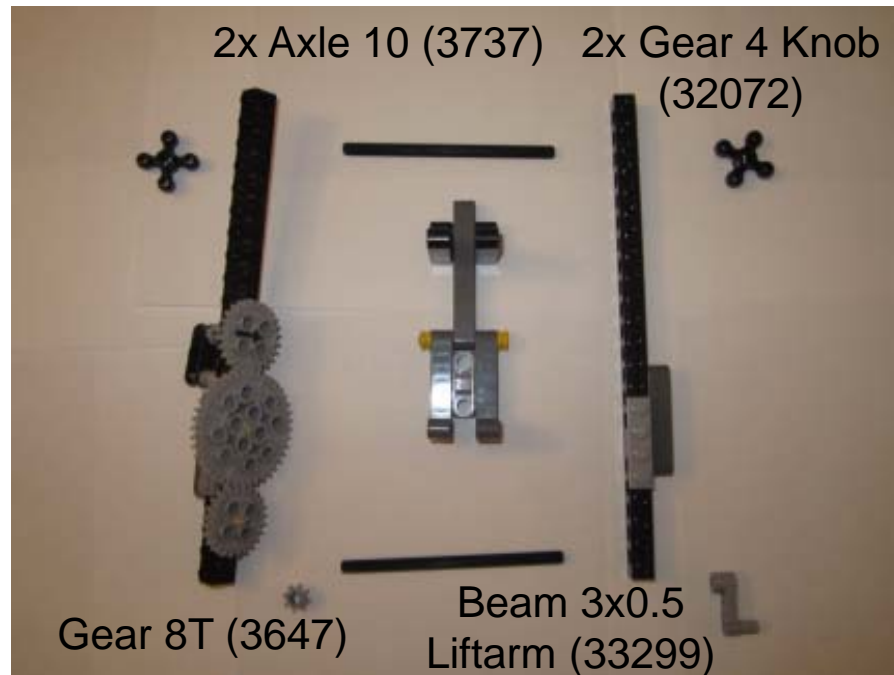


Create upper body by inserting long pins in Beam 7. Create arms by attaching 2x4 liftarms. Create lower body by connecting 3x5 beams to cross block. Attach lower and upper bodies with axle. Secure with 1/2 bushes





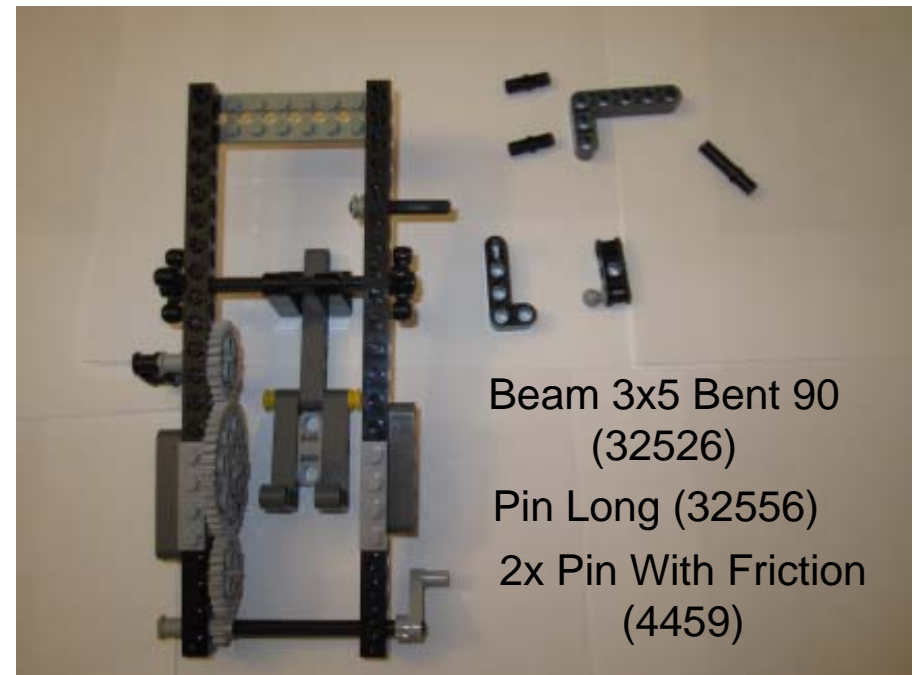
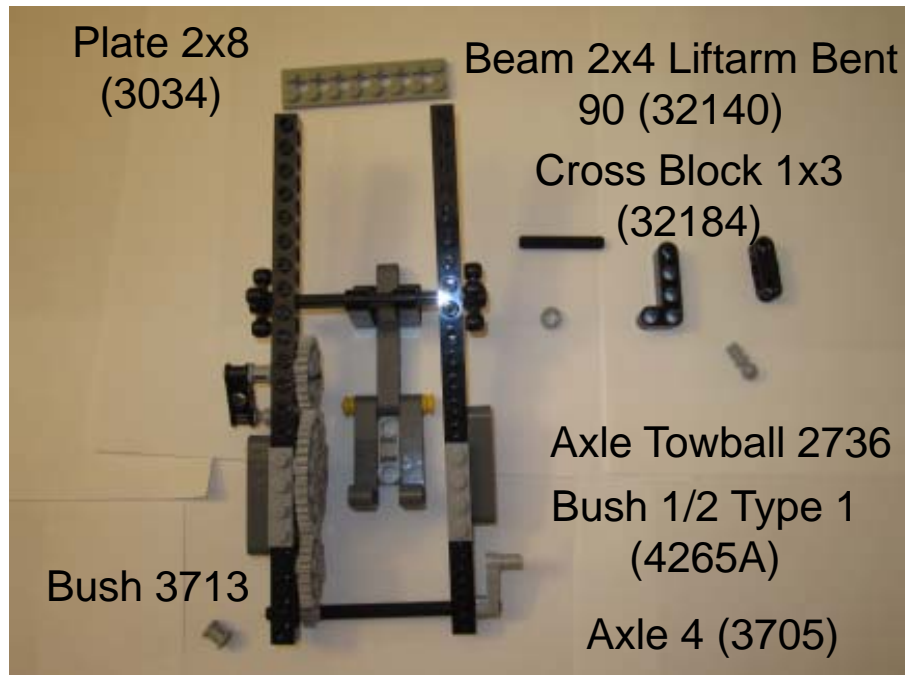
## Step 4: Attach gymnast to rails



Align and thread Axle 10 through gymnast. Secure with 4 knob.

Align and thread Axle 10 at rail bottom. Mesh 8T gear. Secure at end with 3x0.5 liftarm (handle)

## Step 5

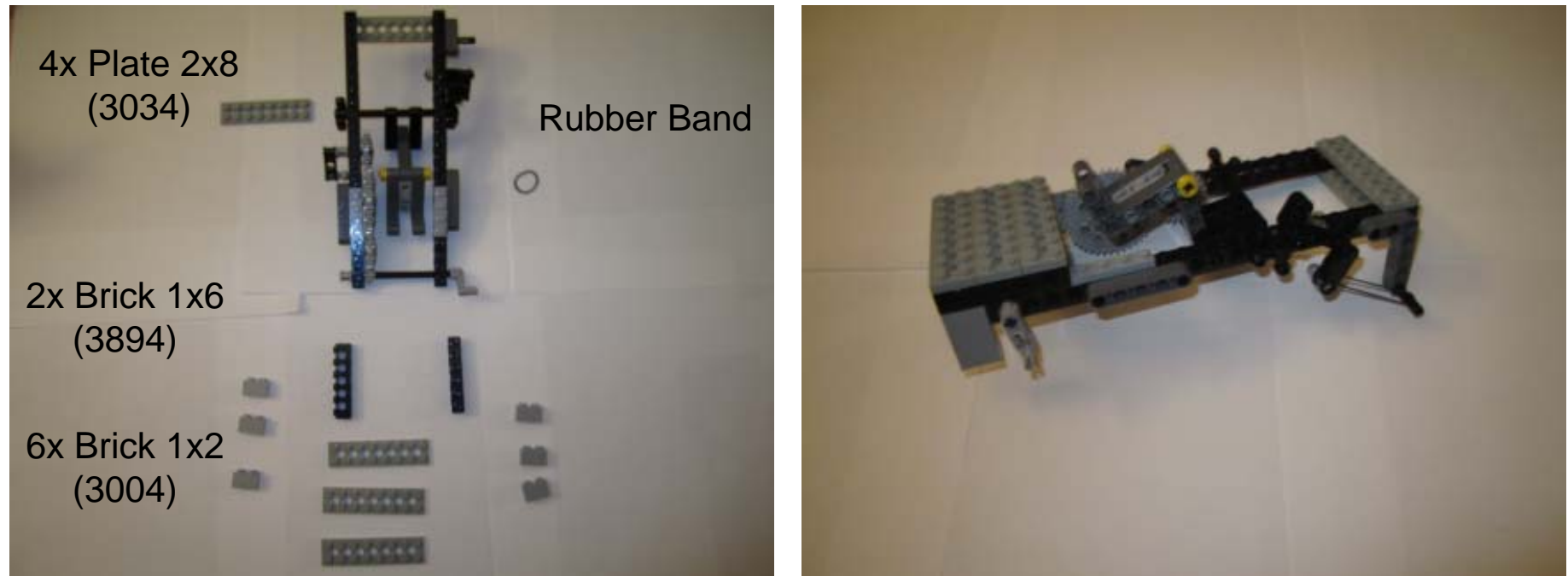


Construct detent by threading Axle 4 through 2x4 liftarm. Secure with 1/2 bush and cross block. Attach towball to cross block. Secure rails with plate. Secure crank axle with bush.

A rubber band will be used for the detent. Attach the 3x5 liftarm to top of rail. Rubber band will be looped to towball and long pin

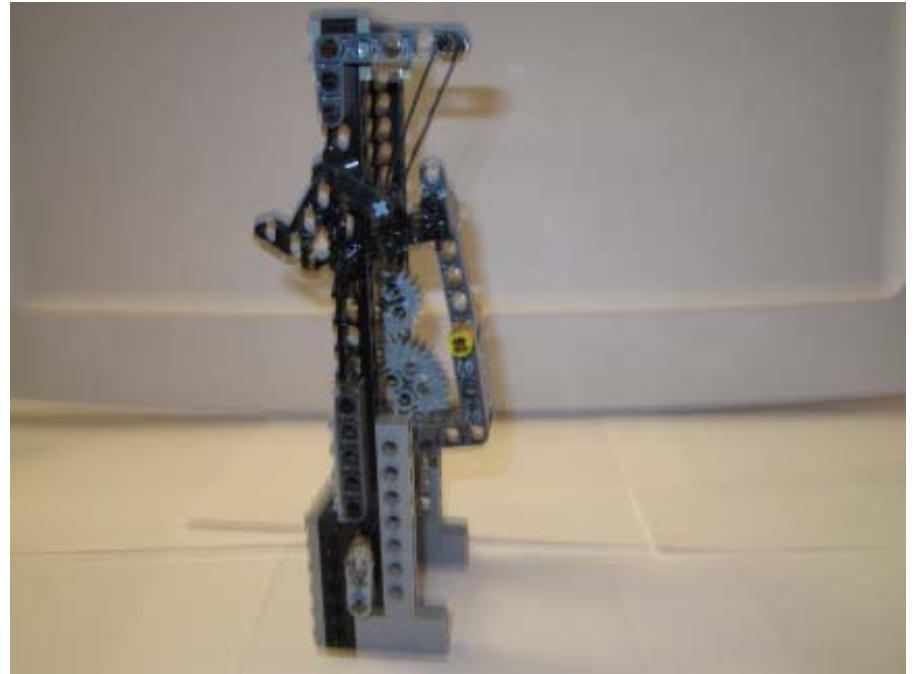
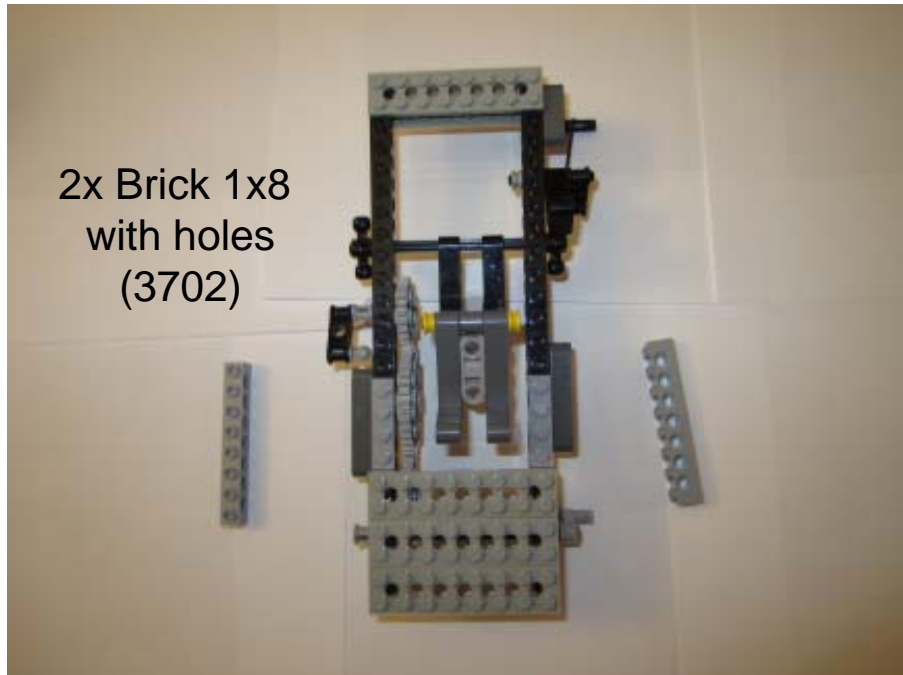


## Step 6



Use 2x8 plates to secure rails at top and bottom. Brace 1x6 bricks at bottom of rail structure. Use 1x2 bricks to complete brace. Loop rubber band at towball and 3x5 liftarm

## Step 7



Secure 1x8 bricks at underneath rails (towards bottom)

# Automata Project

**19:15** Project Time: Form 2-3 person team. Automata sites and concept sketches

**Grading Criteria:** NB: Project counts towards **25% to 35%** of final grade

- Automata must consist of at least 2 simpler mechanisms e.g. crank and ratchet
- Must be only Lego pieces (can self-purchase extra parts if needed)
- Option to work on a 2-3 person team
  - 15%: Brief explanation of how automata works
  - 15%: Video (20-seconds) compares role model and your creation
  - 25%: MLCAD Build instructions including Bill of Materials
  - 25%: Step-by-step build instructions (photo-based). Bring hardcopy to class next week
  - 20%: Oral Presentation (5-min) showcasing the 4 points above

**20:15** Email Team Proposal (3-slides: inspirational video and sketches)

- Web search for Automata that you'd like (and have parts) to reproduce
  - Slide: results of web search
- Concept sketches
  - Slide: scan of concept sketches
- Prototypes: some possible reproductions in Lego
  - Slide: Photos of reproductions, MLCAD constructions