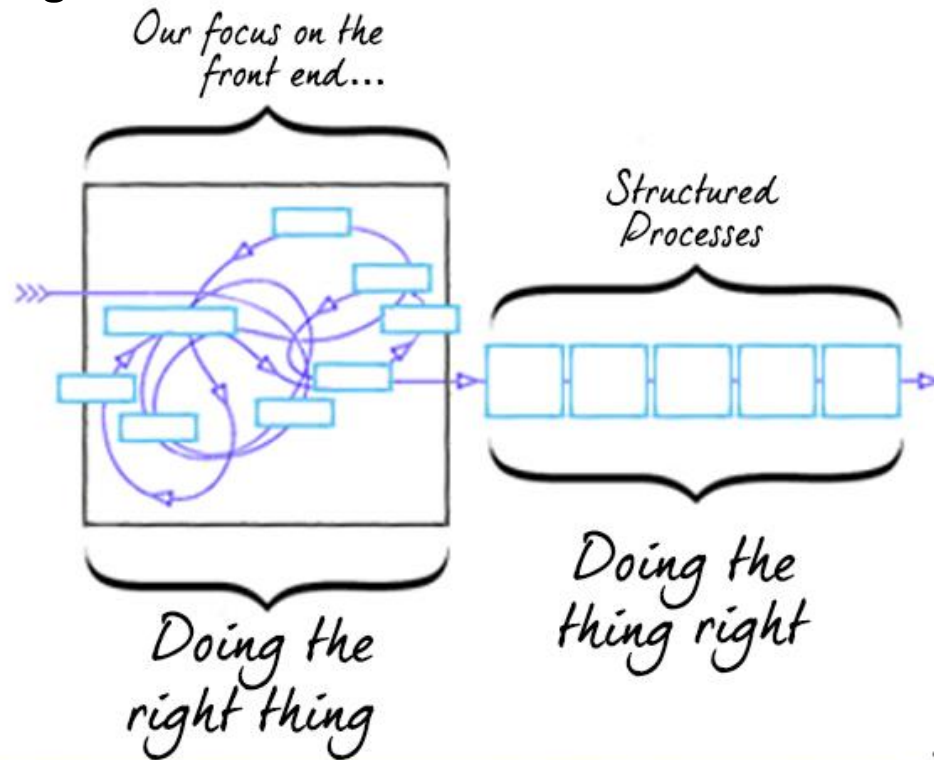


The Shape of Design

Deconstructing Design



The Design Process

Karthik Ramani

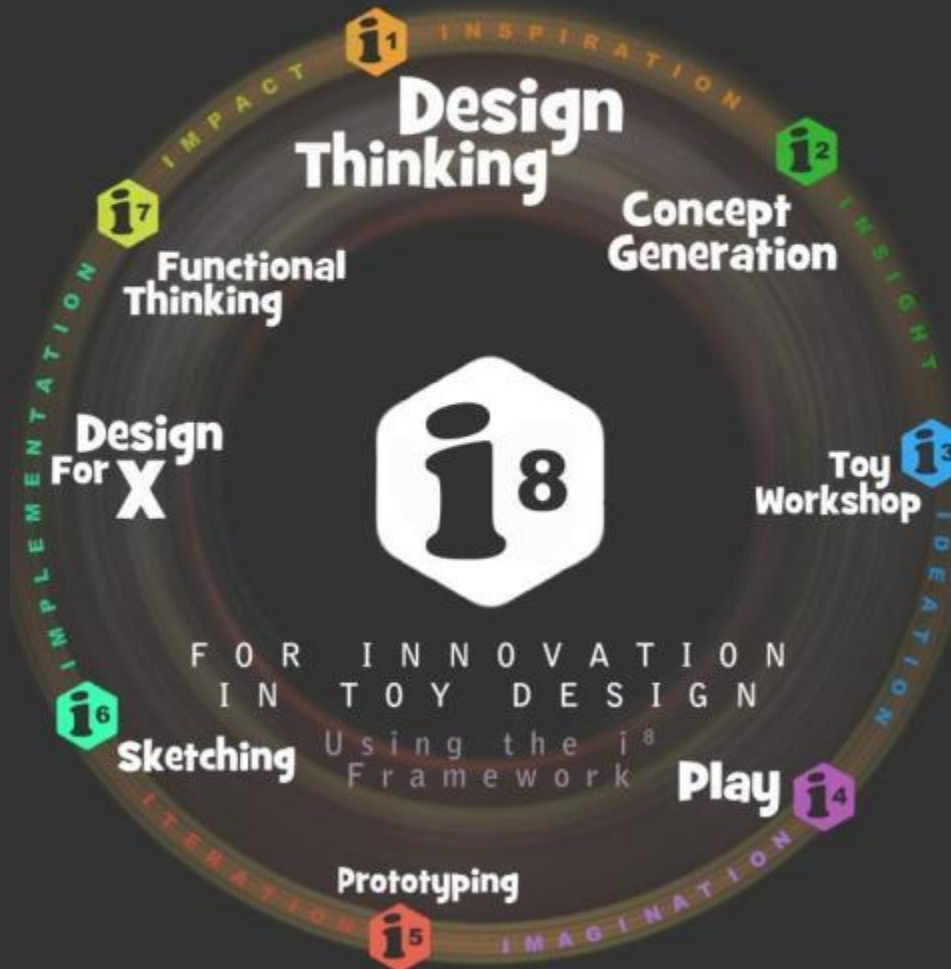
Donald W. Feddersen Professor of Mechanical Engineering

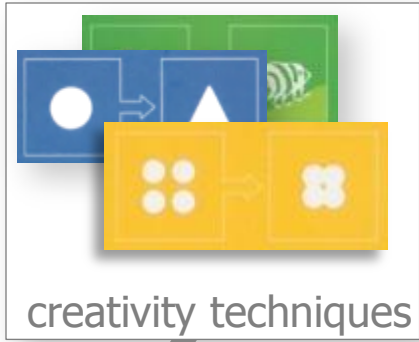
Professor of Electrical and Computer Engineering

Purdue University

ME 444
COMPUTER - AIDED DESIGN
AND PROTOTYPING

Professor: Karthik Ramani
Teaching Assistants: Cecil Piya,
Senthil Chandrasegaran
School of Mechanical Engineering
Purdue University





creativity techniques



sketching workshop



physical prototype

design aided by computers



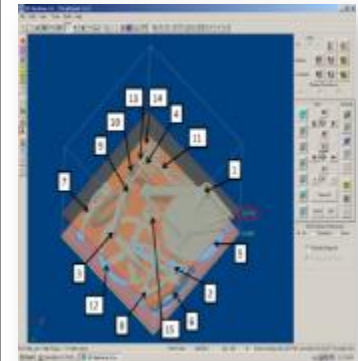
design notebook

- thinking
- visualizing
- recording

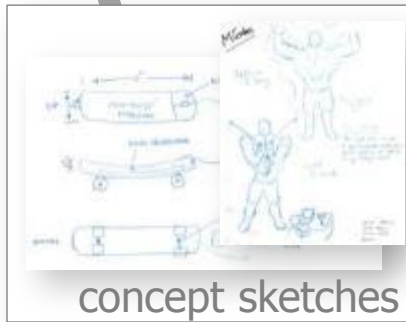


CAD

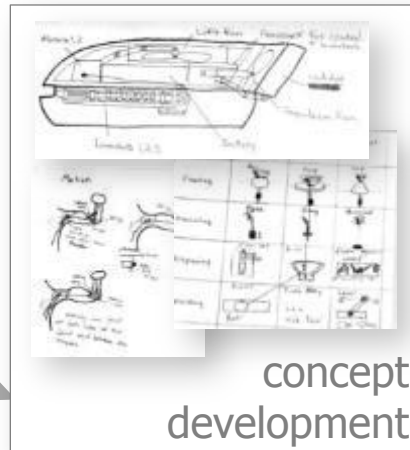
- Complex geometric modeling
- Mechanism design
- Mechanism simulation



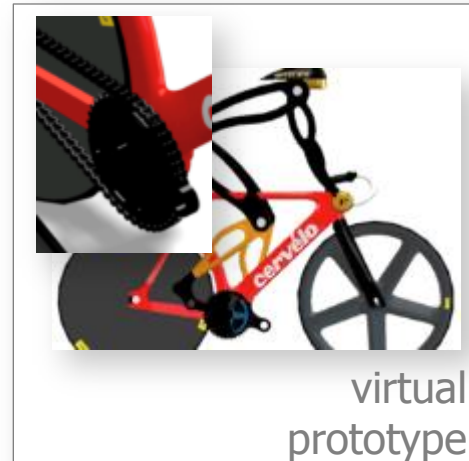
build physical prototype



concept sketches



concept development



virtual prototype



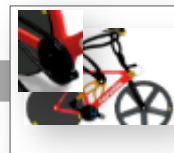
sketching workshop



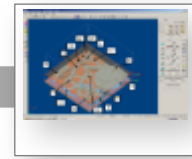
concept sketches



concept development



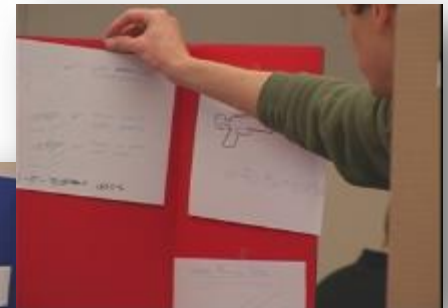
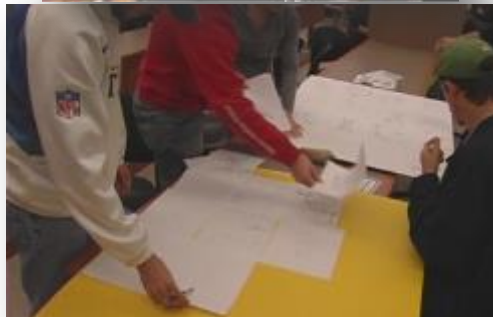
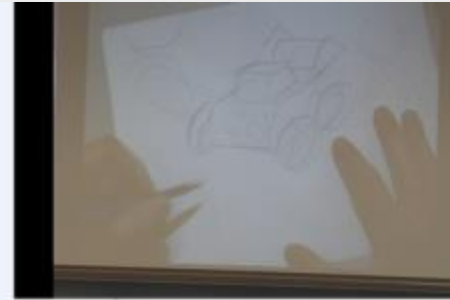
virtual prototype



build physical prototype



physical prototype





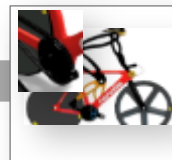
sketching workshop



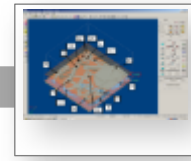
concept sketches



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physical prototype

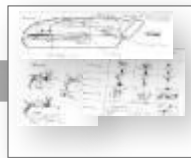




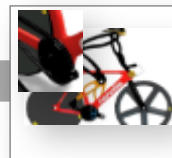
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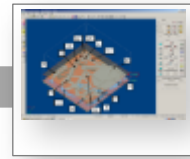
concept sketches



concept development



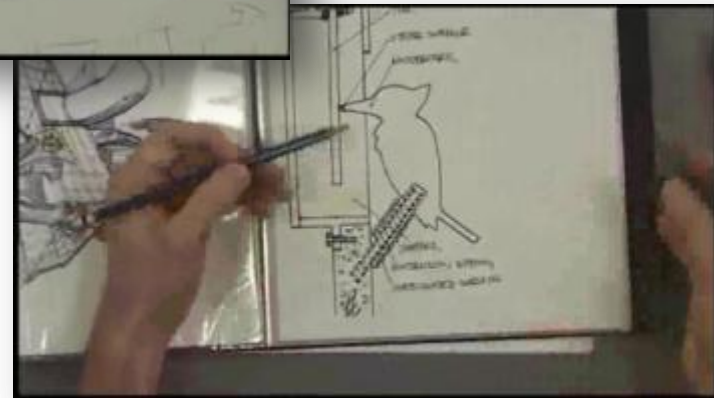
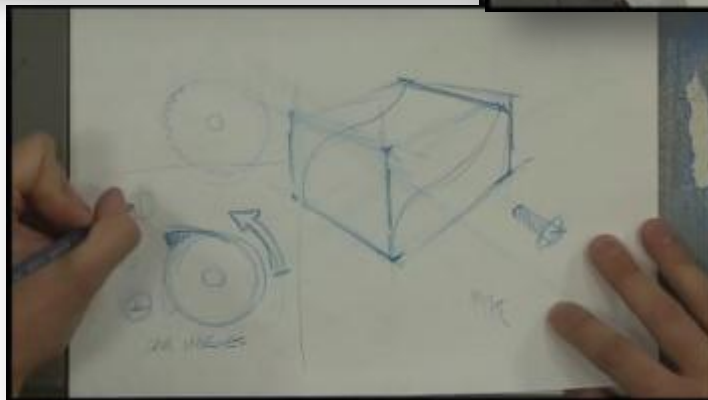
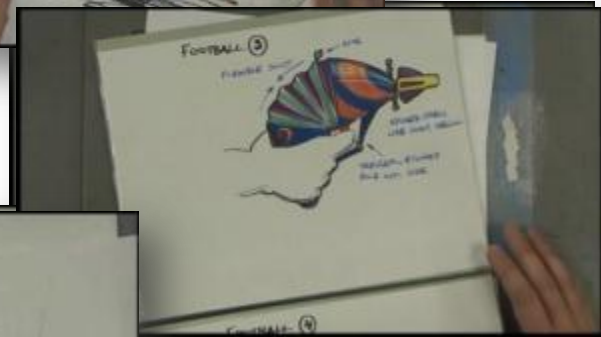
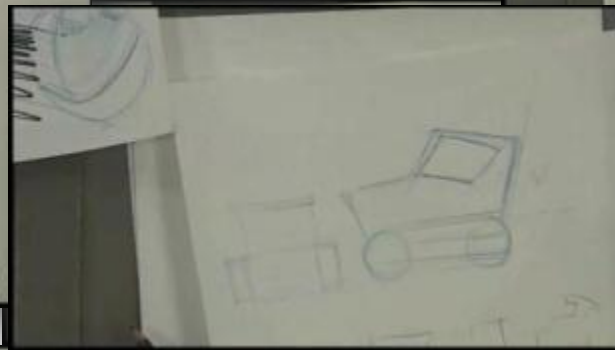
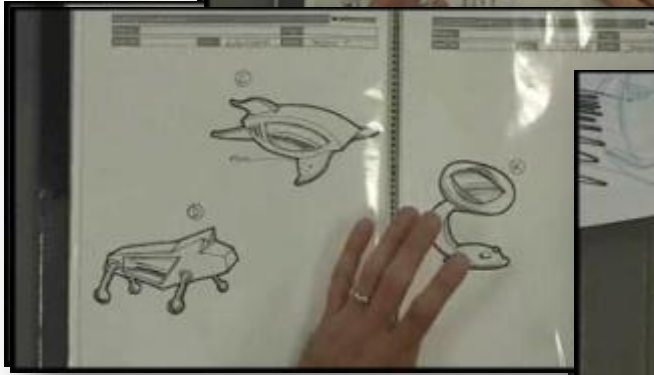
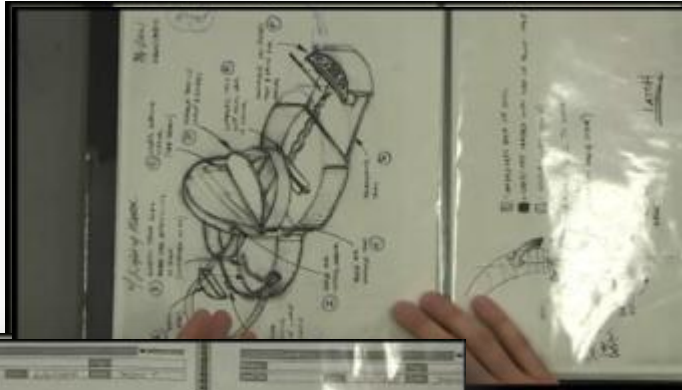
virtual prototype



build physical prototype



physical prototype

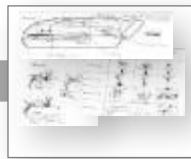




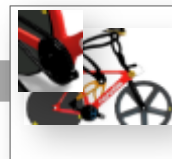
sketching workshop



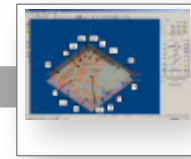
concept sketches



concept development



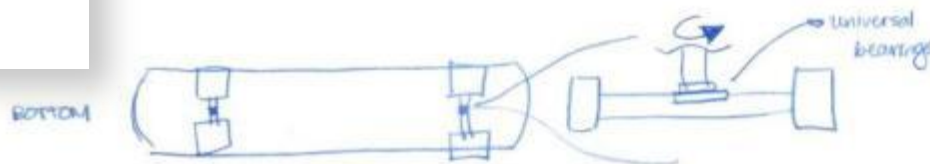
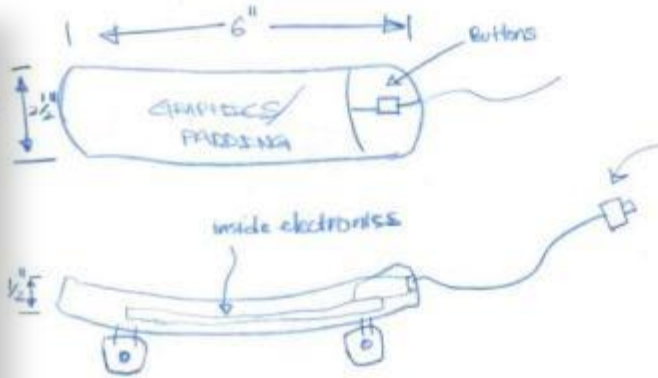
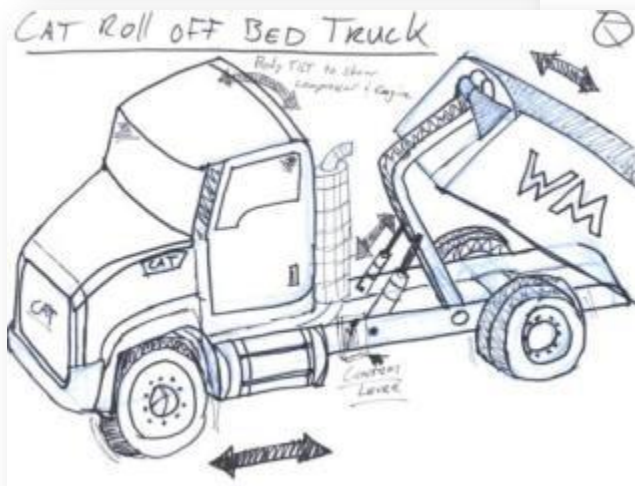
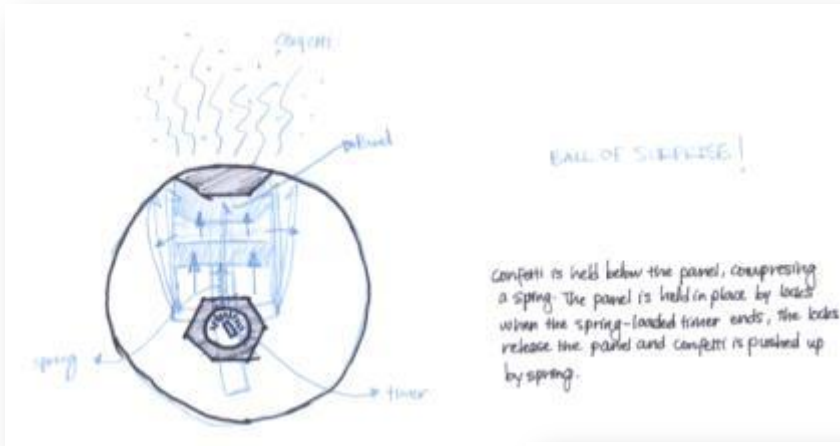
virtual prototype



build physical prototype



physical prototype





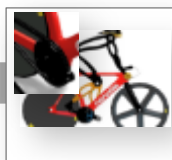
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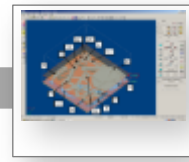
concept sketches



concept development



virtual prototype



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physical prototype

Product Hierarchy

- Product Hierarchy
 - Control Module
 - Control Processor
 - Power Supply
 - Timing and Synchronization
 - Camera
 - Motor
 - Sensors
 - Physical Structure
 - Frame
 - Mounting of sensors
 - Interface
 - Buttons
 - Screen
 - Lighting
 - Speaker
 - Microphone
 - Indicator lights

Bill of Materials

- 2 Servo Motors
- Thrust Bearing
- Flux
- Screws
- Background Material
- Rapid Prototyped Zamboni
- Rapid Prototyped Laser Gun Shell
- LEDs for Zamboni Eyes
- 2.7 Segment Displays for Ammo Count
- Logic
- Sensors for Detect Laser
- Arduino Board
- Wires
- Plush

Scales of Reality

Morphological Matrix

Product: (Real Zamboni Graveyard)	Concept 1	Concept 2	Concept 3
Sub-Functions	Rotate base while lifting/lowering barrel (concept attached)	Bump and tilt base only	Rotate base and tilt barrel
Laser and Sensor Combinations	Laser in gun and sensors on zamboni	attached to gun and sensors on zamboni	attached to zamboni and sensor in gun
Setting Layout	Flat Plate	Inclined hill	Obstacles such as buildings, trees, fences, etc.
Zamboni Motion	Mounted on base (no motion)	Lying down flat and flip up randomly with use of offset gears	Move around base while always standing

Final Component Selection

- Laser gun with rotating base and rotating barrel (two degrees)
 - Laser pointer
 - 2 servo motors
 - Rapid prototyped shell
- Zamboni
 - Sensors to detect laser pointer
 - LEDs for eyes
 - Rapid prototyped body
- Background settings
 - Inclined Hill
 - Obstacles
 - Building
 - Trees
 - Fences
 - Tombarrows

RECTANGULAR CONNECTION

USE OF KEY

THRUST BEARING

CONTROLLER

ASSEMBLY

GUN CONCEPT I TEAM II

THE GRAVEYARD



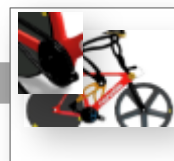
sketching workshop



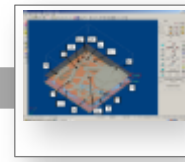
concept sketches



concept development



virtual prototype

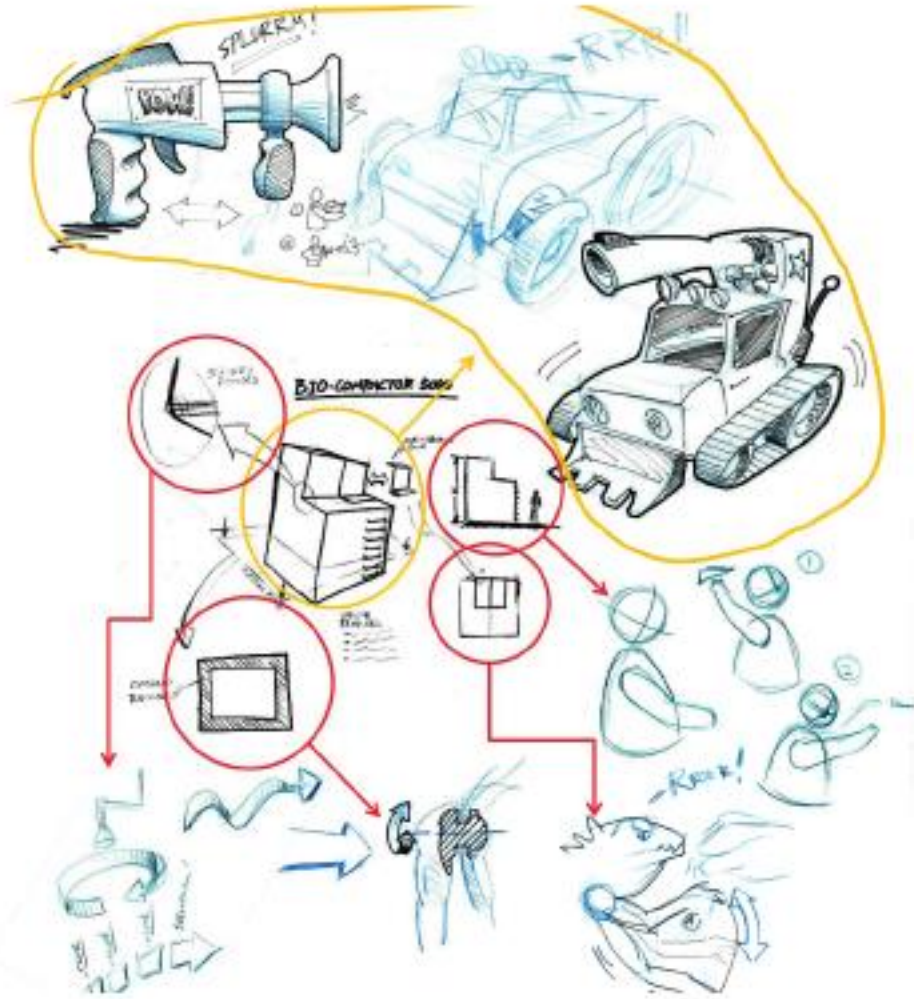


build physical prototype



physical prototype





Lecture

Design and Innovation



Sketching



Injecting Play Values



Creativity Techniques



Laboratory

Hands-on

Demos application



Advanced surfacing



Project: Toy Design





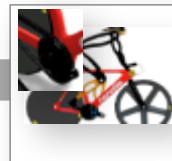
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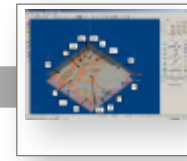
concept sketches



concept development



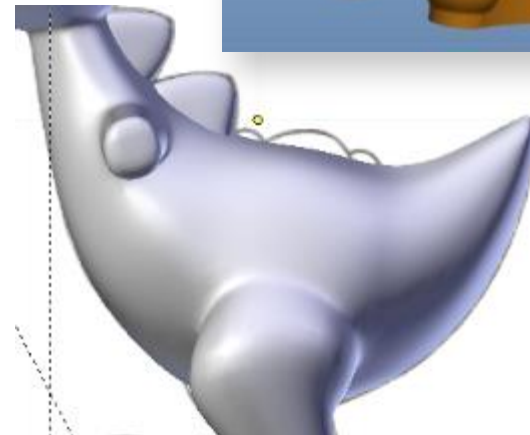
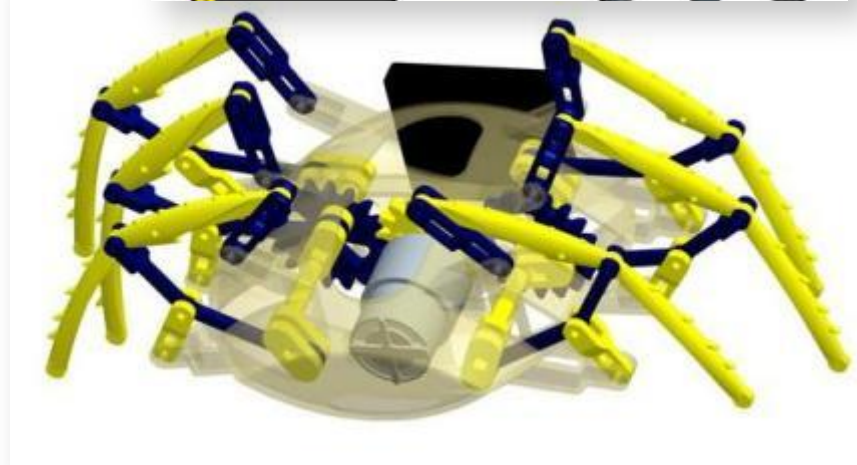
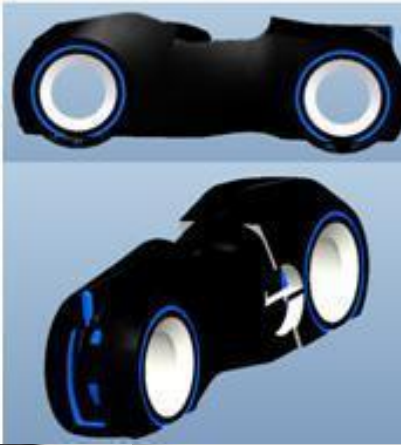
virtual prototype



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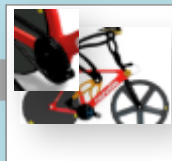
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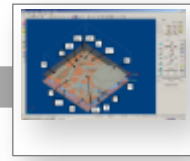
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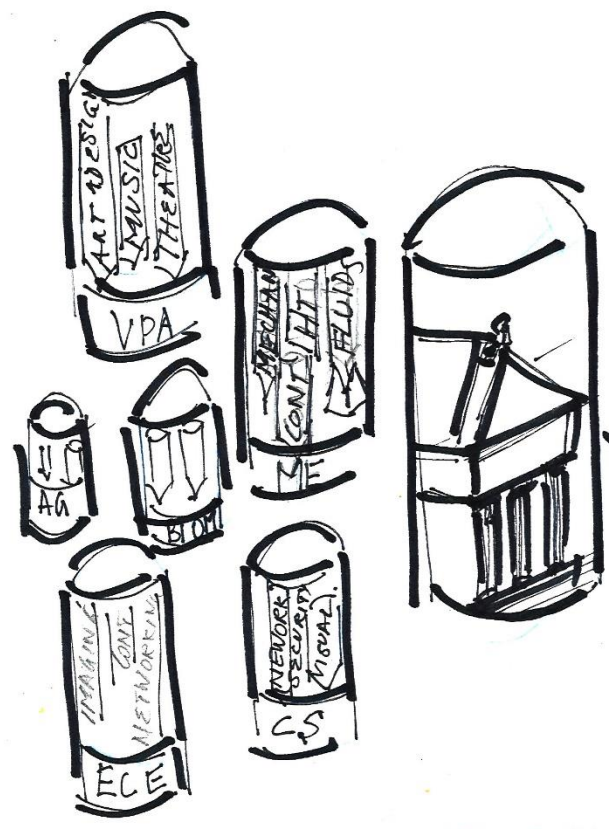
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physical prototype



How engineering is taught: creating "silos" of knowledge



...and how it should be taught

