SolidWorks and Vacuum Forming and Part Finishing oh my!
QR Codes
Decide on one toy concept

3 models

Looks like

Works like

Refined designing and building techniques

Three ideas presentation
March 6
3 ideas per team

Mockup Review
April 17
1 concept, 2 models

Sketch model review
March 20-22
2 concepts, 4 models

Final PLAYsentations
May 14
1 final prototype
Before Lab...

review the feedback! Especially the product you didn't work on

note down interesting points in your lab notebooks

notebooks will be checked in lab!

Decide on one toy concept

Looks like

Works like

2 models

Refined designing and building techniques

Camel

Dyna Bike

Reviewer Name: Josh Ramos

Please fill in bubbles completely: Yes

Plays-Like

Was it clear what question the plays-like was addressing?

no

maybe yes

How effective was it at answering the question?

meh.

wow

N/A

Elaborate on effectiveness:

"Solid platform for testing a multimeter"

"Testing compensation is awkward"

Looks-Like

Was it clear what question the looks-like was addressing?

no

maybe yes

How effective was it at answering the question?

meh.

wow

N/A

Elaborate on effectiveness:

"The control arm could have been explained in more detail"

Overall Concept (play value)

ok

good

amazing

Could be improved with better understanding of human body dynamics

Critical questions they may want to consider:

"What is the action that provides mobility?"
Mockups: Works-like

addressing critical questions for the final product: mechanisms, assembly, remaining questions on play

closer in play to the final product (much less Wizard of Oz!)

reasonable planning and less focus on the appearance
Mockups: Looks-like

close in appearance to the final product

addressing critical questions

visual, sizing (kids and implementation), texture, etc.

technique questions
Workshop: Electronics II
this Sunday 11am-1pm, room TBD
soldering technique
control motors, audio, and more!

signup on the course website
Today!
SolidWorks (here in 3-370)
- Camel
- Crocodile
- Goose
- Hedgehog
- Hippo
- Koala
- Llama
- Lobster

Part Finishing (PDL)
- Ostrich
- Moose
- Narwhal
- Meerkat
- Panda
- Squid
- T-Rex
- Tiger
Team Estimation Game

How many Prudential Centers fit lying down across the Harvard Bridge?

What is the cost per popcorn kernel at the movie theatre?

How much energy does it take to brush your teeth (manually)?

Can you power a mechanical bull in your house on a standard wall outlet?

How long will it take to heat a hot dog with an Easy Bake Oven?
Estimation Game

How many Pru's across the Harvard Bridge?

Pru height?

~230m

Harvard bridge length?

~620m

between 2 and 3
Estimation Game

Cost per kernel of popcorn at the theatre?

price of bucket?

volume of bucket?

volume of popped corn kernel (packing factor)?

~0.25–1¢ per kernel
Estimation Game

Energy to brush?

How fast is your arm moving while brushing?

\[ E_k = 0.5mv^2 \]

How often do you change direction? How long should you brush?

0.5s, 120s

\(~120 \text{ J}\)
Estimation Game

Mechanical Bull in House?

power requirement for mechanical bull?

standard voltage in house?

standard circuit breaker current?

$240V \times 30A = 7200W$

$120V \times 15A = 1800W$

~ sure
Estimation Game

Hot dog in the Easy Bake?

\[ Q = mC_p\Delta T \]

50–200g and 20–60°C

Power of Easy Bake

5-10 min without losses
Quiz!

What is your name?

What is energy? Units?

What is power? Units?

What are the top three sources of electricity in the USA?
Intro to SolidWorks
When to use CAD?

- detailed planning
- calculating
- digital fabrication
When **not** to use CAD?

- quick prototypes
- organic shapes (yet!)
SolidWorks Basics
SolidWorks Navigation

- Command Bar
- Feature Tree
- Model Window
Simple Box

Select the “Front” plane
Create a new sketch
Create a “Center Rectangle” from the origin
Smart Dimension the length and width in inches
Change the View

Change the view to “Trimetric”

Use middle-click and drag to free rotate
Extrude

Extrude the sketch

Choose “Mid Plane”, and set to 3.125"
Modifying the Sketch

Delete the extruded feature (we’ll come back to that later)
Edit the sketch, draw a horizontal line below the box
Set the line as “for construction”
Dimension the line 0.275" below the box
Sketching the Wheel

Draw a circle, connecting the edge to the construction line so it is tangent.

Dimension the circle 1" away from the front.

Dimension the diameter as 42mm (notice it change to inches).
New Sketch

Create a new sketch on the “Front” plane
Use “Convert Entities”
Select the rectangle to convert (this brings it to the new sketch)
Extrude the box as before, with “Mid Plane” & 3.125"
Reference Plane

In the top menu, choose: “Insert > Reference Geometry > Plane”
Set the plane 0.10" away from the box face
New Sketch

Create a new sketch on the new reference plane
Use “Convert Entities” again
Select the circle to bring it onto this new sketch
Extrude the wheel

Extrude the wheel

Set the extrude as “Blind” and to 0.60"

Uncheck the box for “Merge result”  

really, do it!
Round the Corners

Select the “Fillet” tool
Select the edges of the box to fillet
Set the radius to 0.25″
Round the Edges of the Wheels

Select the “Fillet” tool
Select the edges of the wheel to fillet
Set the radius to 0.125"
Mirror the Wheels

Select the “Mirror” tool

Choose to mirror about the “Front” plane

Go to “Bodies to Mirror”, then click on the wheel in the model window (you can check preview to see what will happen)
Mirror the Wheels

Select the “Mirror” tool again

Choose to mirror about the “Right” plane

Go to “Bodies to Mirror”, then click on the two wheels in the model window
Sketch the Canopy

Edit the original sketch on the “Front” plane.

Sketch a line at an angle on the left side.

Draw an arc tangent to the angled line and ending on the right, at the top of the car.

Dimension from the edges: 1.70", 2.00", and angle of 25°.

(Also, try dragging around the point on the left to change the shape of the canopy.)
Extrude the Canopy

Create a new sketch on the “Front” plane
Use “Convert Entities” to bring over the canopy sketch
Draw a line to close the canopy shape
Extrude the canopy using “Mid Plane” and set to 2.25"
Uncheck the box for “Merge result”
Round the Edges of the Canopy

Make sure you unchecked the box for “Merge result” from the previous step

Fillet the top edges of the canopy to 0.35"
Hide the Body

Right click on the feature for the car body, and choose “Hide” to make it invisible

Rotate the view to see the underside of the canopy
Shell the Canopy

Select the “Shell” tool

Set the shell thickness to 0.10"

(notice how this hollows out the canopy)
Glass Canopy

Flip the car back around using “Isometric”
Make the car body visible again by right-clicking “Edit the Appearance” to make it more realistic
Other things to try...

Try modifying the original rectangle for the car body to make it better match the Automoblox cars
What happens when you change the dimension for the “ground clearance” construction line?
Try adding a spoiler or other detail
Make axles and corresponding holes for the wheels
Create new parts from existing bodies

Expand the “Solid Bodies” folder
Right click on the “canopy” body
Choose “Insert into New Part…”
SolidWorks and Vacuum Forming and Part Finishing oh my!

Take blade boxes!