Lab 1-Digital & Physical Models

Description
In this lab you are going to enhance your understanding of spatial thinking and apply that understanding to analyze and develop a simple gimbal assembly in a 2-step process:

1. develop *conceptual map* for a two-gimbal assembly,
2. build a *digital* model of a two-gimbal assembly.

You will find that these steps will likely not occur in the order above, but will be mixed together. This is both normal and desirable.

The first part of the lab is an introduction to a simple 3D digital modeler, Mecabricks, in which you'll become familiar with the tool by building a simple model.

Part 1-Introducing Mecabricks
Follow the demo by your TA. Please find Mecabricks on this website.
https://www.mecabricks.com

Part 2-Concept map for a two-gimbal assembly
Make teams of four (4) and brainstorm concept maps for a mechanism with two gimbals. It is best that each team member makes his or her own sketch, and that they show and discuss the sketches with each other.

A gimbal is a pivoted support that allows an object to rotate about an axis [1]. If two or more gimbals are attached as shown in Figure 1, they provide free rotation of an object about multiple axes. They are used for many purposes; e.g., to keep compasses on ships horizontal or coffee cups in drink holders upright in moving vehicles.

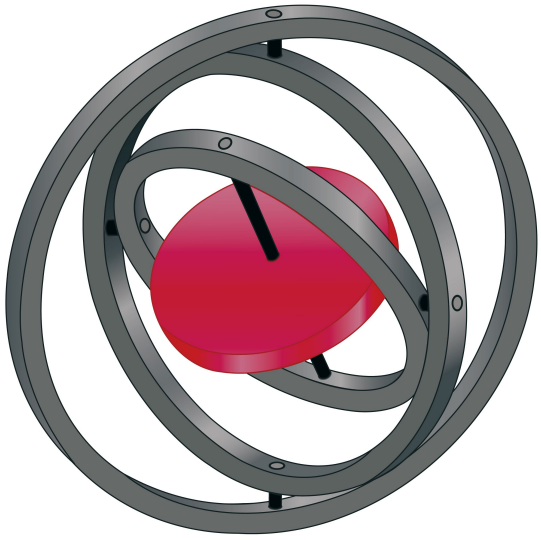


Figure 1: A three-gimbal assembly. Accessed on 6 Jan 2016 at
http://www.gimbalcapital.com/gimbalFinal9.jpg

Part 3-Build a Digital Model of a Two-Gimbal Assembly

You will use the concept map to help you build a two-gimbal assembly (Figure 2) using Mecabricks, a digital-modeling program used for building objects using Lego blocks.

You will work individually for this part of the lab.

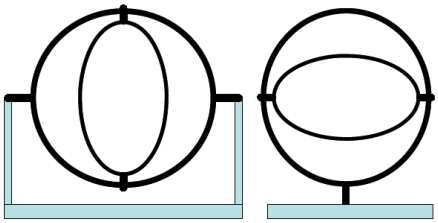


Figure 2: Two variations of a two-gimbal assembly

Just like real Lego blocks, Mecabricks provides you with a set of modular blocks with different shapes, sizes, and functions. However, the blocks are 'digital', that is they are represented in the computer's memory. You can select parts from a list of grouped parts and bring them together using the software. You can insert, rotate, move, attach, or detach them. Unlike the physical Lego blocks, you can copy them, delete them, or change their colors as you wish. In addition, you have an essentially unlimited number of blocks. After building the digital model, you'll save it and submit an accessible link it to your TA using Canvas (see Deliverables section below).

Goal and Objectives

The main goal of this lab is to experiment with the concepts about spatial thinking by working in teams to design an assembly using two representations:

1. To relate spatial thinking concepts to the lab activities; such as objects, space and operations, reasoning (descriptive, analytical, or inferential) and make references between them.
2. To experiment with different representations for analysis, design, and building of simple assemblies with moving parts.
3. To communicate understanding and conceptualization of spaces, objects, and operations to self and others effectively.
4. To practice working in teams

Process

For part-2 of the lab, you are to work in groups of four, however each member submits an individual concept map. For Part 1 and Part 3, you will work alone.

Timing of Lab activities	
Activity	**Time (min)**
Icebreaker	20
Mecabricks overview and demo	15
A small presentation on 'what is a concept map?	15
Develop concept maps for a two-gimbal assembly (groups of 4)	60
Build two-gimbal assembly using Mecabricks (individual)	60

Deliverables

1. Draw and label your concept map and upload on canvas.
2. The links to your digital lego model files are to be shared on Canvas under Lab 1 Digital Lego Model. Save your file on the Mecabricks website as follows:
    a. *studentName>_DigitalGimbal_Lab01*
    (e.g., JohnDill_DigitalGimbal_Lab01)
    b. Upload the link to Canvas.
3. Each student must also submit a report (on Canvas Discussion) For this deliverable, write down the answer to the following questions:
    a. Describe one helpful and one unhelpful quality of each representation used on the labs (concept map and digital model) for the task of devising the gimbal assembly.
    b. Imagine and list three differences and three similarities that you foresee to happen in developing a gimbal in digital environment vs. with physical Lego bricks, in terms of space, objects and operations.

This applies to all writing in this course. We expect you to write to the best of your ability. We expect you use correct grammar, spelling and punctuation. We expect you to be concise, that is, to use fewer words rather than more. Poor writing will result in your work being given a zero mark, irrespective of its content.

Assessment

Criteria and grading are:

Item	Due	Individual or Team	Criteria	Criterion Mark	Item Mark	Total
Concept map	Before lab 2	individual			10	
			Accurate labelling	3		
			Relationships	3		
			Annotations	2		
			Correctness in representation	2		
Digital model	Before lab 2	individual			30	
			is it a complete and practical design?	4		
			Inner ring spins?	8		
			Outer ring spins?	8		
Report	Before lab 2	individual			10	
			appropriateness, accuracy and clarity of answers and writing	10		
TOTAL						50

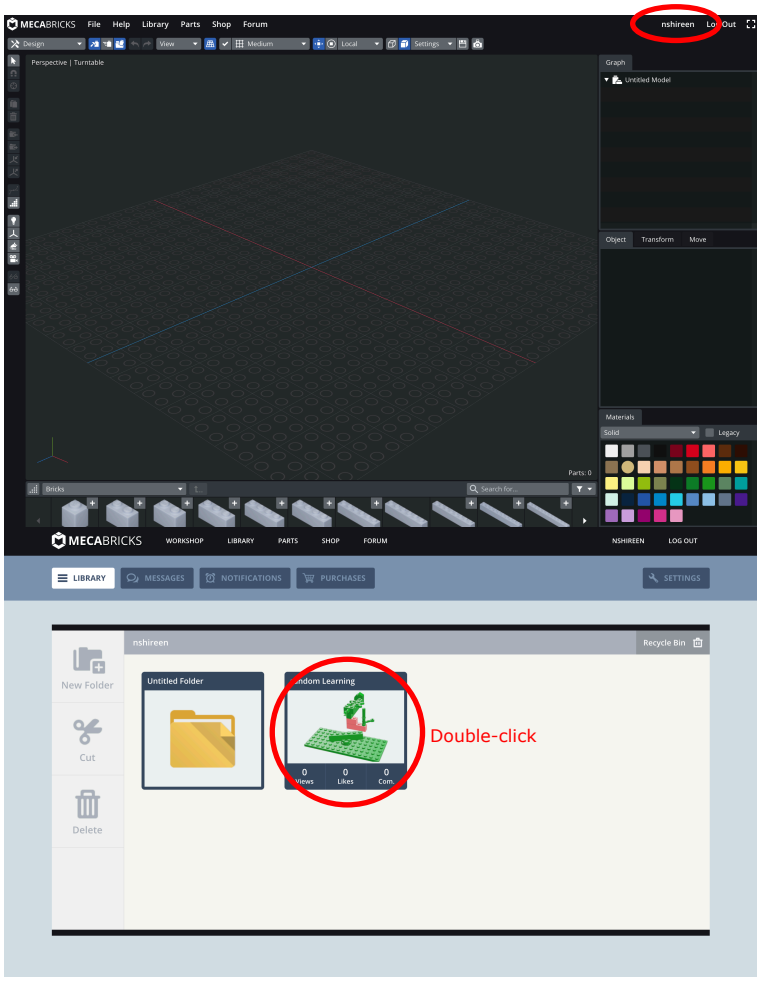
Online Resources:

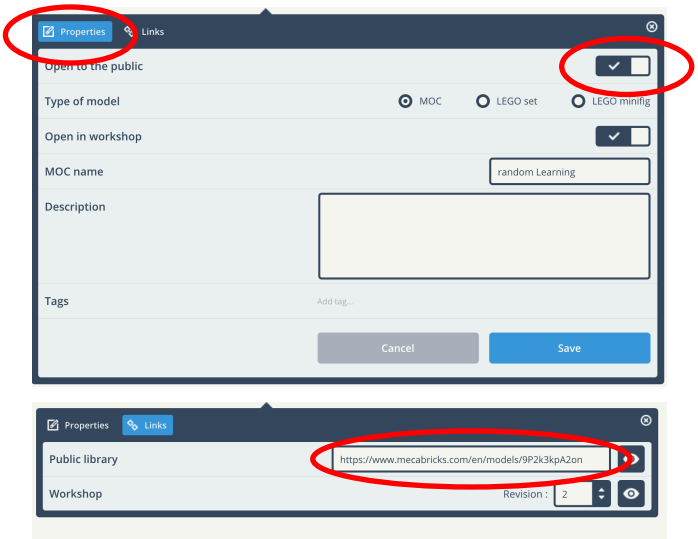
1. Gimbal: http://en.wikipedia.org/wiki/Gimbal
2. Mecabricks: Inserting bricks: https://www.mecabricks.com/en/forum/topic/65
3. Mecabricks: Snapping and rotations: https://www.youtube.com/watch?v=AsDczg1pOFc
4. Mecabricks: Group rotations: https://www.youtube.com/watch?v=eHxH09HUQ0s

File Sharing on Mecabricks:

To share your file on the canvas container, follow the steps (please see the images);

1. Click on your name at the top right corner of the interface, this should open the library with your created files using Mecabricks.
2. Double-click on the file you wish to share as part of your submission.
3. Under the "properties" tab, check the 'Open to the Public' checkbox.
4. Click on the "links" tab
5. Copy the sharable click
6. Paste the link on the canvas submission comment section.




Properties
Links
Open to the public
Type of model
MOC
LEGO set
LEGO minifig
Open in workshop
MOC name
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Add tag...
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Properties
Links
Public library
https://www.mecabricks.com/en/models/9P2k3kpA2on
Workshop
Revision :
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