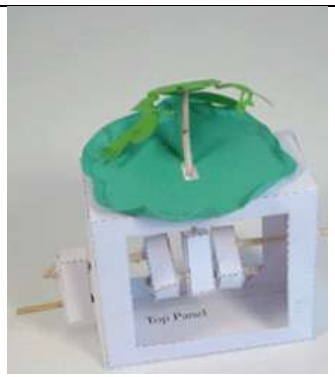
Project 2 - AMT
IAT 106 - Fall 2012

Project Overview
In this project, you will design and build a simple animated mechanical toy (AMT) that will embody two main components: a simple mechanical box and an "animated" figure integrated with it. The Figure below illustrates three examples of AMTs that show a figure connected to a mechanical box.

The mechanical box contains 'mechanisms' that change direction or transform one type of movement to another; such as linear movement to circular or circular movement to linear. When activated by a handle the mechanism 'animates' the figure attached. For example, the 'Bread Chopper' (Figure 1a) has a mechanical box with two cranks moving up and down following the rotation of a shaft causing the Chopper's hands to move in synch with the cams.

AMTs are fun to watch and play with, but, more importantly, designing and making such toys requires knowledge and skills similar to those you are studying and developing in this course.

AMTs can be found in different sizes with various complexities. For this project, we want you to make a simple but functional AMT. For this purpose, you will use select mechanisms that we discuss in lectures and labs to complete your AMTs in the given time.. In this project, you may only use cardstock, foamcore, Styrofoam and simple wood dowels as materials (the 'bread chopper' shown below uses wood as a construction material).

		
A Furious Bread Chopper: (made of wood, which is not allowed for your project!)	Flying pig: http://www.mechanical-toys.com/pig.htm	Jumping Frog: http://www.mechanical-toys.com/frog.htm

AMTs and similar systems have been built for centuries for different reasons; sometimes to imitate nature, sometimes to impress a king, or sometimes to entertain children [1, History section]. Today, they are built by curious puzzle solvers, artists, educators, engineers and scientists [1-7]. It has even become such a business that designs and ready-to-build kits are being marketed online and in specialized shops. Yes, it would be easy to purchase and assemble one; but you would miss the fun of making your own and you would lose the opportunity of testing your knowledge and skills in spatial thinking and communicating. Still, you can learn a lot from these examples.

Purpose
This is a more advanced project than your first creation, the object you sketched, built in cardboard and modeled in SolidWorks. In this project, you'll create and combine several different parts into a working "assembly". It is designed to advance your awareness of spatial thinking while improving your skills in creating and using different

kinds of *representations* (sketches, SolidWorks models, physical models). This project integrates and makes use of the individual lab exercises you have been doing. You will carry out this in groups of two students (see *Format* section).

To assist you in thinking about your project, everyone will do an individual reflective journal or blog (see section below).

Finally, each group will create a poster providing an overview of their project, and will present this with a demo of their AMT during the last lab of the course.

The most relevant spatial thinking issues you explore in this project are

- Defining individual objects as part of an assembly,
- Determining objects' properties--dimensions and shape,
- Spatially relating their relationships and interaction with each other in the assembly, and
- Describing the functions of each part and the complete assembly when taken as a whole.

As you practice and learn about spatial thinking, you will begin to see that it both requires and helps with communicating ideas about spatial objects, both 2D and 3D. You will use the representation techniques and tools you learned and practiced earlier in the course to explore your ideas individually, to share these ideas with others, and to demonstrate what you have learned. These techniques include sketching, digital modeling, physical modeling, and composing different representations to 'market' your designs! The TA and instructor will help groups as they make progress. This project is designed to help you learn how to work in a group while following a plan from the conceptualization stage to the final product.

Objectives

The project's overall objectives are:

1. Analyze existing AMTs with respect to their structure, parts, and assemblies, in order to infer their functionality.
2. Communicate your ideas about AMTs with your other team member in order to create concepts for a new AMT (both the mechanism and the figure).
3. Refine your AMT design using sketching techniques, such as multiview and isometric drawings.
4. Using your sketches, persuade your TA, instructor, and classmates that your idea will work.
5. Using your sketches, model the parts in SolidWorks and then create a working assembly that demonstrates your AMT's functionality. Create a mechanism with minimum one translation and one rotation.
6. Create a physical model of your AMT using your sketches and SolidWorks model as a blueprint.
7. Present and demonstrate your AMT to the class using sketches, your SolidWorks model, physical models, screen-shots, animations, etc.
8. Prepare an individual reflective journal following each major step in the project and use your journal to build team consensus. Prepare a detailed poster overviewing your project.

Process

You will complete the project through incremental and iterative phases. Each week, we will provide instructions describing the objectives, deliverables, and assessment for that week. The overall project is divided as follows:

Week	Objectives
8	Study and analyze existing AMTs, sketch your own AMT and create a concept map, present your AMT to the class. Complete your individual reflective journal
9	Create the AMT parts in SolidWorks based on your sketches. Complete your individual reflective journal
10	Start creating AMT assembly in SolidWorks
11	Continue working on SolidWorks assembly. Complete your individual reflective journal and start working on physical model
12	Complete SolidWorks assembly, complete physical model, complete your individual reflective journal and prepare final presentation and final team report
13	Present and demo your AMT in class

Although the process is listed linearly, we do expect that some aspects of your AMT will change throughout the process. For example, while creating your assembly, you may discover that certain parts need to be modified. Slight modifications throughout the process are accepted while major changes, such as a complete redesign, are not. In general, significant changes after obtaining TA approval of your design are discouraged. If you run into problems and feel change is required, you must obtain permission from both the TA and instructor.

Format

You will do this project in groups of 2, which you form on your own. Once you have formed your group, which you will do in week 8, you may not make any changes. In week 8, each group must submit a 'group charter', (draft version is in "Week8_FinalProject.doc") which outlines the rules of the group. ***Each group member must sign the charter before submitting it to their lab TA.***

The group members should work together in completing the project through each week because each member will be equally responsible for assigned aspects of the AMT.

The group's work submitted throughout the project must be their own. In case of plagiarism, the procedure defined in SFU policies as noted in the syllabus will be followed.

Reflective Blog (Journal)

Each individual is responsible for completing entries in an individual *reflective blog (or "journal") following* the completion of the four major steps in the project. The blog will be reviewed by the TA the following week and you will receive a "complete or incomplete" on each entry. The goal is for you to learn the process of ***reflecting on*** or *thinking about* tasks you have undertaken, in order to better understand and learn from them. Each week you will be given a short list of questions (usually just 2 or 3) to guide you in this process. You are to construct a single document containing all your weekly entries (be sure to put a title and date on each one). Submit the document (or a link to it) each week, via WebCT.

SolidWorks Quiz

In week 11, there will be a short quiz to ensure every group member is participating in the design process and has developed sufficient SolidWorks knowledge and skills.

Assessment & Deliverables

The AMT project is worth 15% of your final IAT106 grade. Each week's handout will clearly list the assessment marks. **On the day of your final presentation, each group is required to submit a CD or DVD containing all the deliverables for their project, a poster and the group's physical model**. The overall distribution of marks is as follows:

Criteria	Marks	
Concept map, sketches of AMT design, oral presentation		30
First version of Solidworks parts & assembly, physical model	10	40
Final SolidWorks assembly	30	
Physical model		20
Poster and presentation		10
TOTAL		100

References and Useful Links

1. http://automata.co.uk/mainpage.html :Commercial and educational AMT products
2. http://flying-pig.co.uk/index.php
3. http://www.cabaret.co.uk/
4. http://www.youtube.com/watch?v=XzQp-9GDpu8 <News clip on Cabaret>
5. http://www.youtube.com/watch?v=Azg1tsTpVo4 :Dog figure playing with ball>
6. http://www.mechanicalmonkey.co.uk/
7. http://www.zuko.to/kobo/english/e-works/e-ctop.html : Japanese AMT Kit website
8. http://www.walterruffler.de/index1.html :Paper machines: exhibition and art of Walter Ruffle