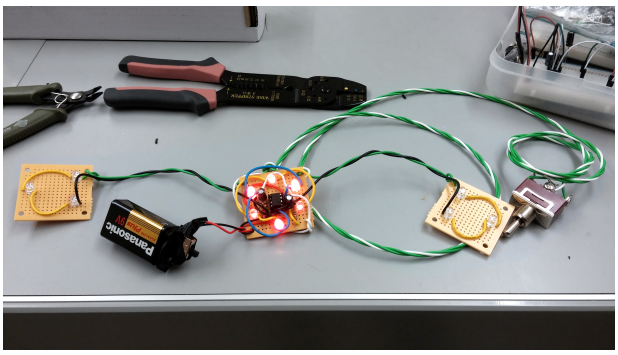
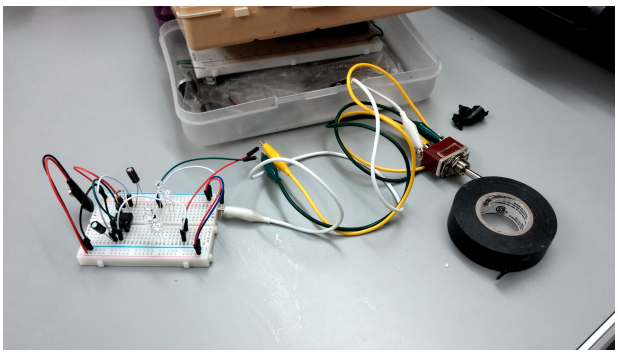
Design Portfolio

Joran W. Booth

Bicycle Turn Signal

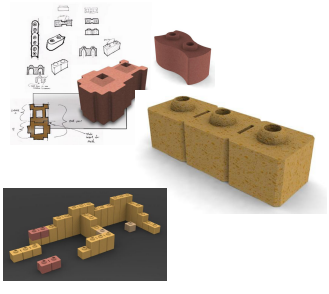
I created this design for a workshop with the Maker's club, and is primarily oriented toward commuter bicyclists and children. The turn signal is attached to the rear of the bicycle and a switch is activated on the front to activate the signals. The wires are laid out to represent the petals of a flower, to improve aesthetics. The design is also with a focus on improving the experience of commuters in traffic and increase the excitement for children playing at home.

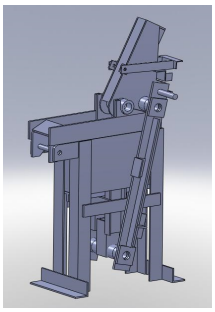


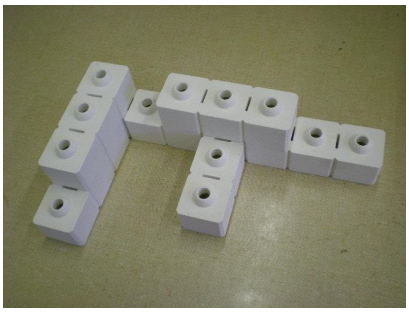


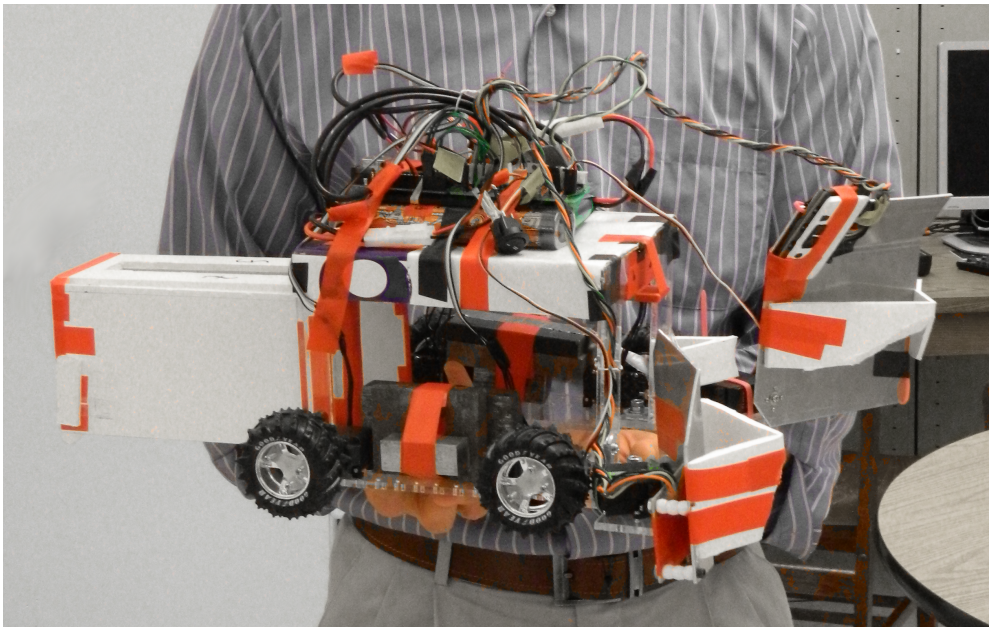
Compressed Soil Block Press

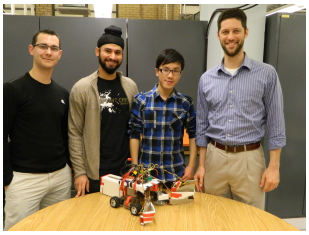
My senior design team and I created a brick design for improving construction in regions where construction materials such as Portland cement powder are prohibitively expensive. This design allows bricks to interlock with each other, reducing the need for cement up to 30%. This approach also affords greater flexibilty when building a house since exterior walls can be securely locked in with interior walls. The mold also creates break points which allow a builder to quickly modify a block for a door or window. This design received extensive attention in the local media and our group won the best presentation award.

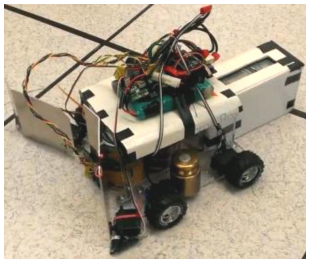


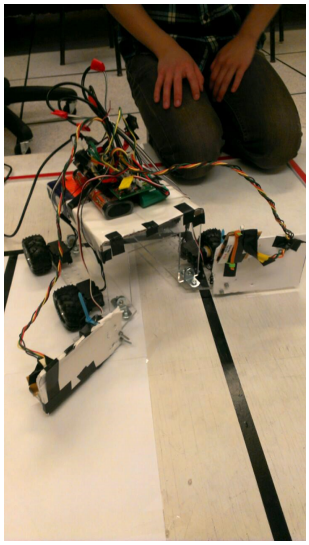








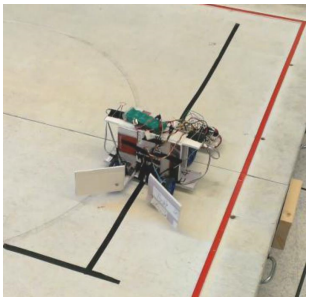


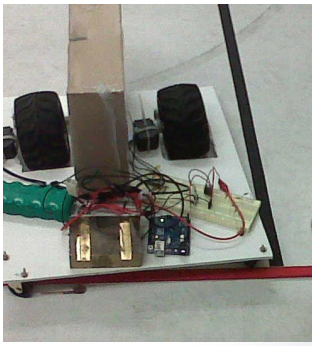


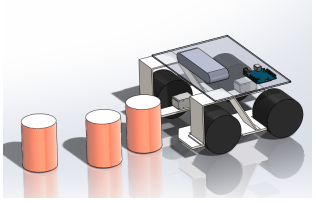
Köllector (Can-Collecting Robot)

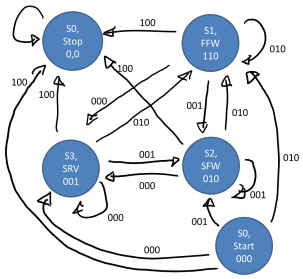
The Köllector was a design my team and I made for a class project. The purpose of the robot was to collect 5 food cans from a designated arena. The robot then had to deposit the cans in a hole.

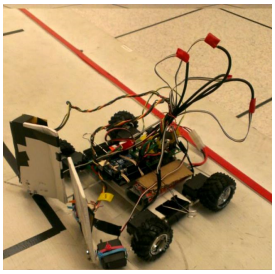
When our team set out to design the robot, I created several serial prototypes to test different ideas before fully committing to them. This prototyping-to-think approach proved to be much faster than the other teams, giving us time to fine-tune our design. Our robot was the only one that semester to successfully complete the task.

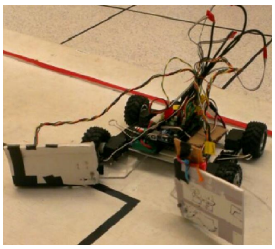


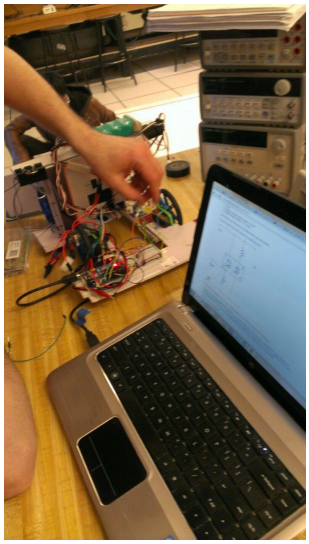












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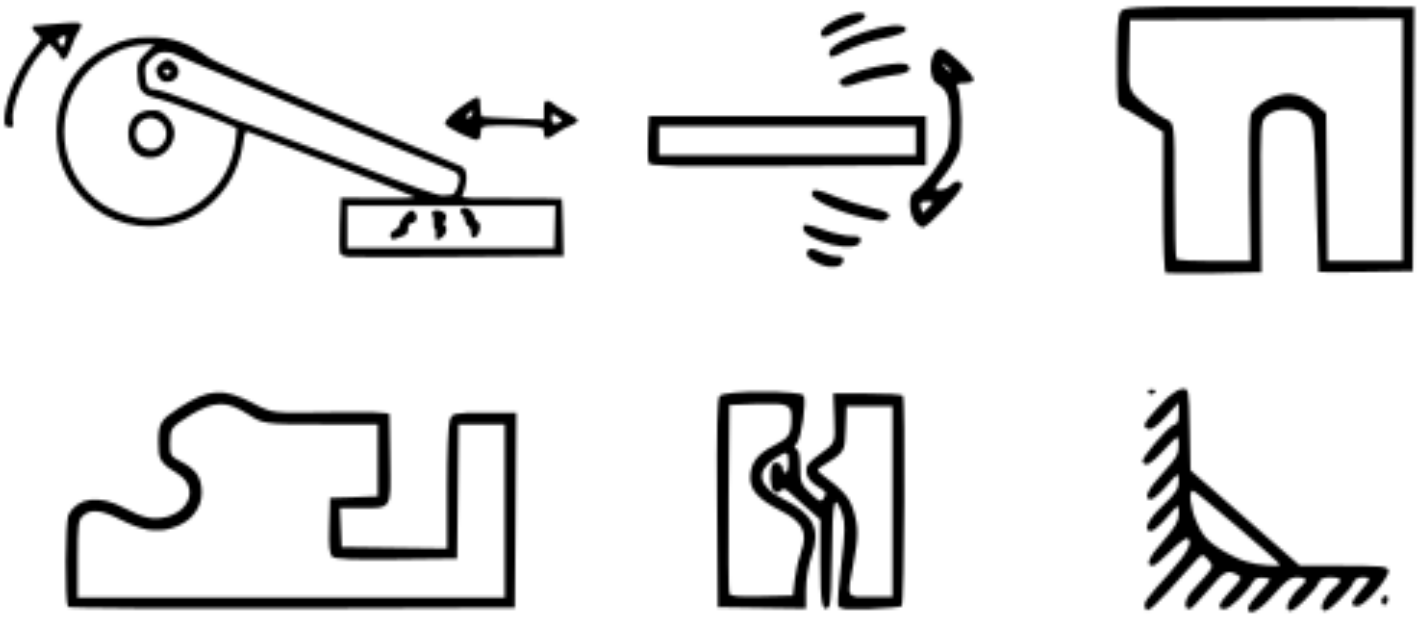
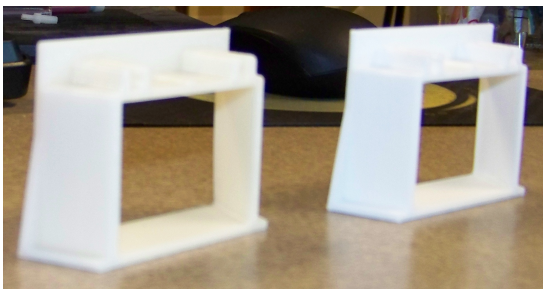


The Design for Additive Manufacturing Worksheet

After working as a monitor for a 3D printing lab at Purdue, I realized that many novices to additive manufacturing (AM) did not understand when to use it or how to design their parts well for it. I also saw that in high-level design courses, students who used AM infrequently would print parts like axles or plates.

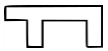
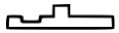
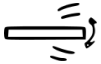
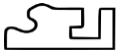
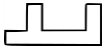
After consulting with several AM experts, I developd a simple list of principles for AM and adapted these into an easy-to-use worksheet. It is intended for novice and infrequent users of AM, and thus is perfect for Makers, engineers who outsource their AM, or students new to 3D printing. This worksheet has already been implemented in two 3D printing labs, one AM research laboratory, one makerspace, and two design courses.

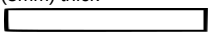
The worksheet
-- Advises if AM is a good method for making a part
-- Advises if a design is likely to succeed on the first print
-- Uses pictures to improve recall when using the sheet a 2nd+ time
-- Uses a scale for each AM principle in order to suggest potential design improvements
-- Is open source - people and companies are free to use it
-- Is simple and intuitive - the first use is 5 min. and less than 1 min after



Design for Additive Manufacturing

A quick method for reducing the number of printing and prototyping failures, by Joran Booth
Instructions: Mark one for each category for the part you plan to print. Check daggers and stars first, then scores

Mark One	Complexity	Mark One	Functionality	Mark One	Material Removal	Mark One	Unsupported Features	Sum Across Rows	Totals
†O	The part is the same shape as common stock materials, or is completely 2D 	*O	Mating surfaces are bearing surfaces, or are expected to endure for 1000+ of cycles 	O	The part is smaller than or the same size as the required support structure 	O	There are long, unsupported features 	x1 =	
*O	The part is mostly 2D and can be made in a mill or lathe without repositioning it in the clamp 	*O	Mating surfaces move significantly, experience large forces, or must endure 100-1000 cycles. 	O	There are small gaps that will require support structures 	O	There are short, unsupported features 	x2 =	
O	The part can be made in a mill or lathe, but only after repositioning it in the clamp at least once 	O	Mating surfaces move somewhat, experience moderate forces, or are expected to last 10-100 cycles 	O	Internal cavities, channels, or holes do not have openings for removing materials 	O	Overhang features have a slopped support 	x3 =	
O	The part curvature is complex (splines or arcs) for a machining operation such as a mill or lathe 	O	Mating surfaces will move minimally, experience low forces, or are intended to endure 2-10 cycles 	O	Material can be easily removed from internal cavities, channels, or holes 	O	Overhanging features have a minimum of 45deg support 	x4 =	
O	There are interior features or surface curvature is too complex to be machined 	O	Surfaces are purely non-functional or experience virtually no cycles 	O	There are no internal cavities, channels, or holes 	O	Part is oriented so there are no overhanging features 	x5 =	

Mark One	Thin Features	Mark One	Stress Concentration	Mark One	Tolerances	Mark One	Geometric Exactness		+
O	Some walls are less than 1/16" (1.5mm) thick	O	Interior corners have no chamfer, fillet, or rib 	O	Hole or length dimensions are nominal	O	The part has large, flat surfaces or has a form that is important to be exact 	x1 =	
O	Walls are between 1/16" (1.5mm) and 1/8" (3mm) thick 	O	Interior corners have chamfers, fillets, and/or ribs 	O	Hole or length tolerances are adjusted for shrinkage or fit	O	The part has medium-sized, flat surfaces, or forms that are should be close to exact 	x3 =	
O	Walls are more than 1/8" (3mm thick 	O	Interior corners have generous chamfers, fillets, and/or ribs 	O	Hole and length tolerances are considered or are not important	O	The part has small or no flat surfaces, or forms that need to be exact	x5 =	
									=

Starred Ratings

*	Consider a different manufacturing process
†	Strongly consider a different manufacturing process

Total Score

8-15	Needs redesign
16-24	Consider redesign
25-32	Moderate likelihood of success
33-40	Higher likelihood of success

Overall Total

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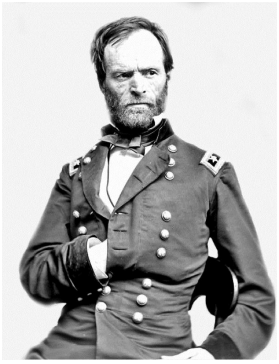
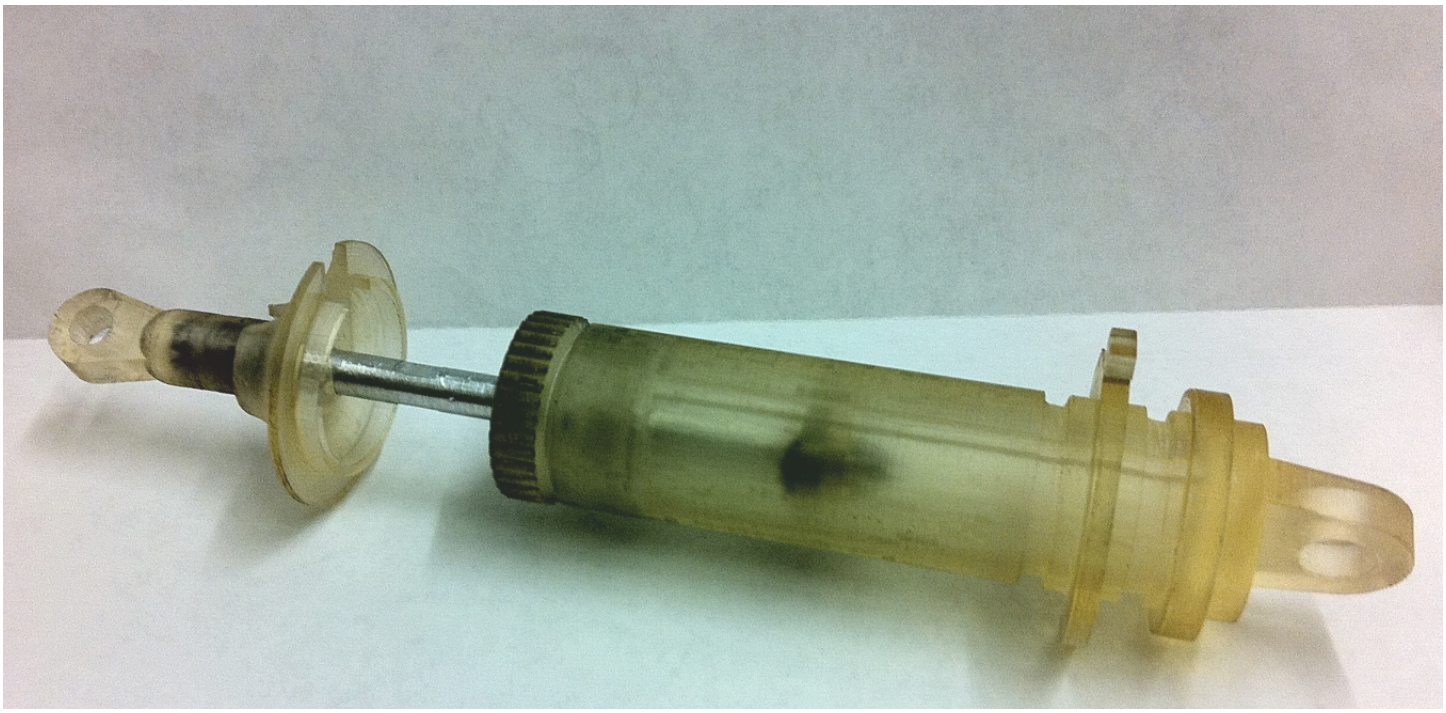
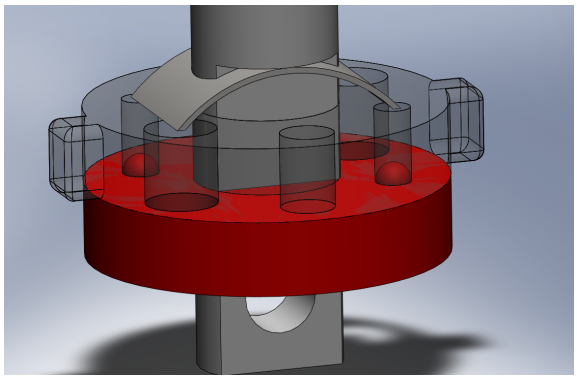
Intrigue (Wooden Card Game)

When I learned about laser cutting, I wanted to see its limitations, especially with regards to rendering images. I created original artwork for an existing game (Coup) and produced copies of the game on 1/8" plywood. I decided on portraits from the American Civil War, since these are in the public domain and it would create a cohesive theme for the project. I used several 19th century coins as inspiration for the coins and other tokens in the game (below).



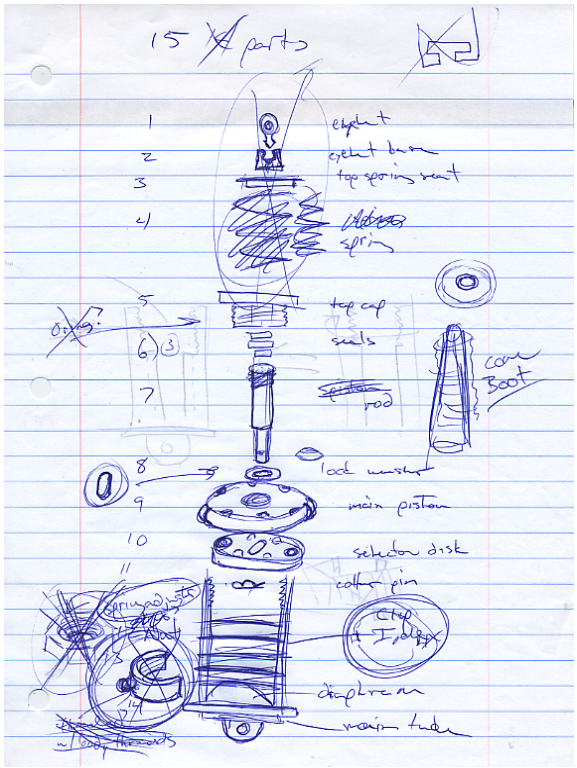


Ergonomic Variable Shock Absorber



The Traxxas R/C vehicle line uses miniature versions of automotive components, including shock absorbers. The original shock abosrber uses many parts and requires a complete disassembly of the shock to change its damping properities.

My teammates and I redesigned the damper to make changing its properties easy and intuitive. The operator simply turns the shaft of the shock in order to change the hole diameter that the fluid moves through. This reduced the part count and time to tune a vehicle.



When creating this project, we made extensive use of sketches. Only when we had finalized our design, we moved to CAD. We made a single prototyping using SLA 3D printing.

This project taught me the importance of early iteration using sketches and how to manage the design process.

Adjustable Lap Desk

The adjustable desk (Roto-Desk) was created to give a firm platform that a student could do homework on. The desk was designed to be used on the floor, in bed, on a couch, outside or other locations. The design features quick release joints to change the position of the desktop, a pencil stop, and a magnetic writing surface that could be used as a whiteboard.

This project taught me the importance of making something yourself. It also taught me advanced machining skills such as CNC milling.