

24-672

DIY

DESIGN AND FABRICATION

PROBLEMSET

1

COFFEE CUP CONUNDRUM

Carnegie Mellon University



PROBLEM SET 1: COFFEE CUP CONUNDRUM

Story – Spacebucks, the world’s premier artisan coffee franchise, wishes to replace those pesky paper heat jackets with a sleeker alternative. A Pittsburgh-based design firm, Carnegie Design Inc., has been invited to propose a new design to Spacebucks along with three other competing design firms. Carnegie Design contacted you, a freelance DIY Designer and Fabricator, to assist them in the competition. Spacebucks requires that the new design enable its customers to grab a piping hot coffee or latte without burning themselves. Carnegie Design asked you to design the paper jacket that a customer can “assemble” easily from a flat piece of paper. Your new paper cut holder design was well received by Carnegie Design, and the company has proposed your design to Spacebucks and won a big contract.

Hearing Carnegie Design’s success with Spacebucks, three local companies have asked Carnegie Design to design a sturdier, reusable alternative to a paper jacket constructed from 1/8” acrylic.

In this problem set, you will design a new acrylic coffee cup holder according to the requests of one of the following companies:

1. Moody Judy Inc.

This company sells snappy artisan T-shirts to angsty teenagers, and their artsy storefront boasts a variety of homegrown teas, available for free to their shoppers. Hoping to keep their shoppers’ focus on the shirts and not on their scalded hands, they have commissioned you to design a cup-holder according to the following criteria:

Aesthetic Pleasure: Your employers are artists. They want cup-grippers as snazzy as their Doctor Who beach tanks.

Environmental Concern: Your employers also love the Earth, and want to waste as little material as possible. Minimize the **total material used** in your fabrication process, including both prototypes and the final product.

Form: For whatever inexplicable, hippie reasons, your employers require that your final product be made of **one piece** of acrylic. No assembly required.



2. ShiMountain Man, LLC.

Professor Shimada's wildly successful outdoor supply company, ShiMountain Man specializes in extreme camping equipment. They have successfully developed a collapsible metal coffee cup that can be heated directly over a campfire for all your morning coffee needs, no kettle necessary. However, they now require a complementary device with which to grip this cup. They've provided the following design requirements:



Durability: Your employer does not care much for looks (who's going to judge your coffee-cup holder when you're alone in the middle of the Rockies? A grizzly bear?), but he does want it to be sturdy and reliable. *Design for strength.*

Portability (Mass): Your employer hates lugging a 325-pound pack every time he hikes Machu Picchu. *Your final product should weigh as little as possible.*

Portability (Form): Your employer understands that every camper has limited backpack space, and would like you to keep this in mind during your design process. *Design your product for convenient carrying in/on a backpack.*

3. MYKEA

The personalized home-accessory company founded by a disgruntled Ikea employee, MYKEA, is like an Ikea for your back-scratchers and sporks. Citing the recent spike in burns caused by home-espresso machines, they've commissioned you to develop a MYKEA MyCup MyCoffee grabber according to the followings restraints:



Aesthetic Consistency: MYKEA is known for their sleek and simple designs. *Design with Ikea in mind.*

Form: If you've ever purchased an Ikea bookshelf, you know their motto is "Some Assembly Required." Your employer requires that your *final product consist of at least two pieces.*

Market flux: The acrylic market has recently tanked, and supplies have tripled in cost. For this reason, emphasize modeling and engineering design over extensive prototyping. *Use as little prototype material as possible.*

MATERIALS AND TOOLS

Some materials and tools are made available for this problem set.

MATERIALS

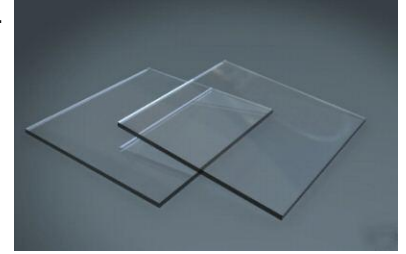


The following materials will be handed out to you during designated lecture time.

- An 8 oz paper cup
- One 6" x 24" sheet of acrylic. (Use this for the final fabrication. Do not waste the material and keep all the scraps -- you may need to use the same sheet of acrylic for building a future problem set.)

You may also want to use:

- Sheets of paper or cardboard for ideation and measurement



TOOLS

For fabrication, the following tools will be available to you:

- Laser Cutter (available in MechE and IDEATe Machine Shops)
- Heat Guns (available in MechE UG Lab)
- Cutter knives (available in MechE UG Lab)

For taking photos and videos of your final product, design processes, and fabrication processes, you can use:

- Digital cameras (available in MechE UG Lab.)
- Desktop photo studio sets (available in MechE UG Lab.)
- Your own camera/mobile phone.



DESIGN AND FABRICATION

Follow the three design and fabrication steps described below.

1. WRITE PRODUCT DESCRIPTION

Choose your target client (Moody Judy Inc., ShiMoutain Man LLC, or MYKEA). Come up with a name for your product and write:

- a one-paragraph description of your product
- a description of the product features

This is similar to the information that an online market website, such as amazon.com, presents for each of the products on its web page. For example, if you search "Eco-Products EG-2000 Ecogrip Recycled Coffee Jacket" on www.amazon.com, you will find the following product and feature descriptions.

Eco-Products EG-2000 Ecogrip Recycled Coffee Jacket

Product Description

The Eco-Products EG-2000 EcoGrip recycled coffee jacket helps keep drinks warm and protect hands from heat, and is made from 100% recycled content with up to 85% post-consumer waste. The coffee jacket, or hot cup sleeve, has a textured design to allow ease of gripping.

Product Features

- *Paper coffee jacket helps keep drinks warm and protect hands from heat*
- *Made from 100% recycled content with up to 85% post-consumer waste*
- *Textured design for ease of gripping*



Writing the product description and feature descriptions will help you define the characteristics of your target design.

2. MAKE IDEA SKETCHES AND ROUGH PROTOTYPES

Sketch out your design ideas in your class sketchbook, the one you received on 9/6 (Tue). Come up with as many ideas as possible, but at least five ideas. Make quick and rough sketches of them so that you can later narrow them down to one or two promising ideas. (Note: make sure to keep all of your idea sketches – you will need to make images of them and submit them to your AFS hand-in directory. You will also use them for your DIY project web page later.)

You should prototype each idea with paper or cardboard first to ensure accurate geometry, test ergonomic quality, and assess visual appeal. Take some photos/videos of the paper prototyping process.

3. FINALIZE YOUR DESIGN AND FABRICATE THE FINAL PRODUCT

Choose the final design and make more detailed design sketches and more carefully built prototypes.

Once the design is finalized, generate a 2D pattern of the final design and turn it into a 2D pattern for laser cutting. Use the laser cutter in the MechE or IDeATe Machine Shop to cut out the final design. You may want to then bend or shape your acrylic with a heat gun or assemble your final product from several pieces.

NOTE: Please be conscious of the costs of prototyping materials and make your cuts as efficient as possible. The acrylic remaining from this project may be used in future problem sets.

DELIVERABLES AND GRADING

WHAT YOU NEED TO SUBMIT

Bring your **final product** and submit it at the beginning of class on 9/20 (Tue).

Submit to your group assigned TA via email in a .ZIP file:

- **PDF file of a one-page, letter-size, product flyer** that includes:
 - Target client
 - Product name
 - Product description
 - Product features
 - 1-5 product image(s)

Note:

- Pay attention to how the information is presented effectively and in an eye-pleasing way in a single page.
- Do NOT include your name/identity in the flyer.
- Name the PDF file:
LastName_FirstName_ps1_000_flyer.pdf.
For example if you name is Andrew Carnegie, your PDF file should be named:
"Carnegie_Andrew_ps1_000_flyer.pdf".

- **1 - 5 image and/or video files that best describe your final product**

Note:

- Each video file should not exceed 20 seconds.
- The total length of all video files should not exceed 1 min.
- Name the image and video files using the naming convention,
LastName_FirstName_ps1_1##_product.png.
For example, if you choose to submit two images and one video,
name them:
 - Carnegie_Andrew_ps1_101_product.png
 - Carnegie_Andrew_ps1_102_product.png
 - Carnegie_Andrew_ps1_103_product.mp4
- For image file format, use one of the following formats: png, jpg, tif. (png preferred)
- For video file format, use one of the following formats: mp4, avi, mov, wmv. (mp4 preferred)
- You may add sound/voice to your video clips.
- Include your images/videos in a sub-directory of the .ZIP called "IMAGES AND VIDEOS".

- **10 - 15 image and/or video files that best describe your design and fabrication processes.**

Note:

- Each video file should not exceed 20 seconds.
- The total length of all video files should not exceed 2 min.
- Name the image and video files using the naming convention, LastName_FirstName_ps1_2##_process.png. For example, if you choose to submit 12 images and one video, name them:
 - Carnegie_Andrew_ps1_201_process.png
 - Carnegie_Andrew_ps1_202_process.mp4
 - ...
 - ...
 - Carnegie_Andrew_ps1_213_process.png
- You may add sound/voice to your video clips.
- Include your images/videos in a sub-directory of the .ZIP called "PROCESS". Adding captions to your images/videos is encouraged to make your "presentation" easy to follow.

HOW DOES THE TEACHING TEAM EVALUATE YOUR WORK?

We will unzip all the files in your hand-in directory, "ps1," and view them in the ascending order of file names.

If you follow the naming instructions correctly, this will show us your one-page flyer first, then the set of images/videos that describe the final products, and finally the set of images/videos that show the design and fabrication processes.

We will evaluate your performance in terms of:

Completeness – Did the student submit all the items asked?

Attention to detail – Did the student follow the instructions?

Design quality – Did the student consider all the design requirements and come up with a good design? How much thought and creativity were put into the design?

Fabrication quality – Did the student choose the best fabrication method and demonstrate a high level of fabrication skills?

One-page flyer – Is the document written with "clarity, brevity, simplicity, and humanity"?

Images / videos – Did the student choose an appropriate set of images and videos to show the final product and design-fabrication process? Does the set of images and videos present the product and process clearly? Are they presented in a way that is pleasing to the eye?

For questions and comments about this document
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