

ESG ES.729, DESIGN PROJECT I OVERVIEW
 Conceive, Design, Prototype, & Evaluate
 a Device to Keep a Cup of Coffee Hot for 2 Hours

DESIGN PROBLEM

- Proposition 1: Hot coffee gets cold (physical principle)
- Proposition 2: Dave is less happy when his coffee is cold (customer’s problem)
- Proposition 3: Dave drinks coffee from standard, large, paper coffee cups (customer)
- Proposition 4: The world is a better place when Dave is happy (generalization of problem)

Taken together, these propositions suggest the imperative of conceiving, designing, prototyping, and testing a product that will keep a standard, large, paper coffee cup, $\frac{3}{4}$ full of coffee, hot for the 2 hour duration of an ES.729 class. The product shall be made from scrap cardboard and rubber cement.

In addition to the requirement that the coffee remain hot, the product must satisfy three subsidiary requirements:

- The product must not expose the coffee drinker to undo hazard
- The product must be ergonomic and aesthetically pleasing
- The product must have a small ecological footprint, both in terms of the materials used to construct the product and the labor required to produce the product.

These requirements factor into the ultimate requirement that the coffee remain hot according to the rubric in Table 1.

Table 1 “cost” of subsidiary requirements

requirement	cost incurred
Safe	The product must pass the tilt test, the pour test, and the roving eye test of due diligence. Any product that does not pass these tests is disqualified.
Ergonomics & Aesthetics	<p>A panel of experts will judge your prototype and place it in one of three categories: top quartile, middle quartiles, and bottom quartile.</p> <ul style="list-style-type: none"> • Products in the top quartile will have 10 minutes deducted from the time at which the temperature is measured. • Products in the bottom quartile will have 10 minutes added to the time at which the temperature measured.
Eco-friendly	<ul style="list-style-type: none"> • If the mass of the product is less than the mass of the coffee, 10 minutes deducted from the time at which the temperature is measured. • If the mass of the product is more than twice the mass of the coffee, 10 minutes will be added to the time at which the temperature is measured. • If the product can be assembled in fewer than 15 minutes, 10 minutes will be deducted from the time at which the temperature is measured. • If the product requires more than 30 minutes to assemble, 10 minutes will be added to the time at which the temperature is measured.

THE DESIGN PROBLEM RECAST AS A COMMUNICATION TASK

Communication elements are intrinsic to complex design tasks. The communication elements described below in Table 2 focus on the single design task and span a range of formality, purpose, genre, and audience. Table 2 identifies the intertwined communication and design activities required to complete design project I

Table 2 Design Project I workflow/assignments, **roughly** in order of occurrence

Activity	Deliverables	Due dates
idea generation/ brainstorming	sketches and scrawls in your notebook that identify: <ul style="list-style-type: none"> • functions and configurations suitable for cardboard (~10) in notebook 	Sept. 5 (done in class)
Critical analysis, FRDPARRC, & selection	<ul style="list-style-type: none"> • design spaces for coffee container insulators (~3) in notebook • design embodiments of coffee keeper warmers (~3 for each <i>space</i>, ~9 total) in notebook research: reading & personal communication • white paper on heat transfer (see white paper assignment) • very informal proposal for what experimentation you'll do on Sept 12&13 (in notebook) • rough FRDPARRC table for each design space (in notebook) • "princess bride" VLOG • selection criteria table (in notebook) • 4 page .pdf document with scans/photos from your notebook: your selected design, the winnowing/selection criteria you used to choose this design, the rough FRDPARRC table, and the big questions you have that are critical to your design • be ready to deliver an informal presentation of design ("proposal") with chalk 	Sept. 10 (before class) Sept. 10 (before class) Sept. 10 (before class) Sept. 10 (before/during class) Sept. 12 (before class) Sept. 12 (in class) Sept. 17 (before class)
	<ul style="list-style-type: none"> • 4 page .pdf document with scans/photos from your notebook: your selected design, the winnowing/selection criteria you used to choose this design, the rough FRDPARRC table, and the big questions you have that are critical to your design • be ready to deliver an informal presentation of design ("proposal") with chalk 	Sept. 12 (before class) Sept. 12 (in class)
reading	<ul style="list-style-type: none"> → complete the qualtrics Communication Intensive self-assessment questionnaire → reading commentary in your notebook on the ES.033 syllabus, rough semester schedule, processes, and design process graphic; these documents are at the top of the list at: http://web.mit.edu/21w.732-esg/www/ → reading commentary in your notebook on Pogue's NYTimes camera review (photo I, & photo II) and Clisset's vegetable peeler review and/or the OXO good grips case study: which parts of the reviews make you think you're having a discussion with the author? If these links don't work, look on the stellar site... 	Sept. 10 (before class) Sept. 17 (before class) Sept. 17 (before class)
propose design	<ul style="list-style-type: none"> • (written) design proposal, draft I • prepare your pitch for design review (semi-formal design review presentation—"oral proposal") • (written) design proposal, draft II 	Sept. 24 (before class) Sept. 24 (before class) Oct. 1 (before class)
prototype	product prototype—document the prototype, its construction, & its characteristics in your notebook; be sure to take photos & perhaps video; consider the purposes and audiences for these images	Sept 11-21ish
implement	construct the final device	Sept. 22-30ish
test	test results in notebook & photo documentation of results	Sept. 30
visit by VPs	Present your design and prototype to the vice presidents of engineering and marketing	Oct. 1ish
report	preparation of oral presentation for delivery on Oct. 12 written report draft I final report	Oct. 10 Oct. 10 Oct. 17
debrief	reflection memo "performance review" w/ Dave	Oct. 17 (before class) Oct. 18 ± 1

Design project I assignments will overlap with other assignments (not listed here) starting Sept. 10ish.