User-Centered Product Definition for Creative Engineering Design

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The objective of this short course is to give participants an introduction to methods used in the Stanford M.E. Design Group, and in some design firms in "Silicon Valley," to promote user-centered design. The course content is taken in part from the first part of a graduate design sequence at Stanford, ME310abc (http://me310.stanford.edu), and focuses on the early stages of product development, when the main challenge is to determine _what to design._

In ME310abc, teams of graduate students at Stanford collaborate with partner teams at various universities around the world to address problem statements provided by corporate partners. Specific methods introduced in the first part of the course include: _structured brainstorming_ and _design definition_, _user and technology benchmarking_, _persona_ development and _critical experience_ and _critical function_ prototyping.

For the purposes of this condensed version of ME310a, participants will form teams to address a technology-driven challenge with sample materials provided by the instructor. After experiencing and practicing the various design methods introduced, participants will present design proposals for possible product development.

The course is recommended for graduate engineers interested in engineering design that addresses the (sometimes hidden) real needs of users. Enrollment will be limited to 32 participants (8 teams of 4).

A course schedule is attached on the next pages.

Proposed Short Course Outline: **New Product Ideation**   Dates: 5 March – 16 April   *version:* 17-Feb-13 © Mark R. Cutkosky

Week	Day 1	Day 2	Materials, references	Meetings

1 (5/3)	Course Introduction
	  Intro. to Stanford/IDEO creative engineering
	  design process, tools, activities
	  Deep Dive video (DDV)
	  "needs pull" vs "technology push" and a closer
	  look at schedule.
	  Topic introduction & begin technical
	  background as time permits.
			ME310 Outline
			Deep Dive Video (mpeg)
			2011-12 ME310 Corning Glass
			example
			Brainstorming slides
			Directional adhesion slides
			(adapt from MRS2012)	

(7/3)		Team formation Continue topic technical background. & bio-inspired design. Distribute samples. Brainstorming intro (ref. DDV) Brainstorming session	Need materials: large sheets of paper (1-2 per team) or whiteboards (1/team) and markers for brainstorming. Need breakout space for N teams.	Schedule short meetings before next class, with each team to review brainstorming results and candidate idea(s), suggest benchmarking.
Results	Week 1 provides participants with an introductory understanding of the "Stanford D.school/IDEO" design methodology and, particularly, what is done in the early stages of new product development .			

2 (12/3)	Benchmarking and Need-Finding
	  Technology Benchmarking: Looking inside and
	  outside of a discipline.
	  Experience Benchmarking
	  "Extreme users."
	  Persona development.
			Directional adhesion slides
			(adapt from MRS2012)
			Benchmarking & Persona
			slides from ME310
			Need materials: large sheets of paper (1-2 per team)	

(14/3)		Short presentations by teams of chosen candidate topics and personas. Ideas for refinement, modeling, benchmarking, testing.	Distribute Stanford gecko adhesive samples now, if not earlier (2 per team)	
Results	Week 2 provides a bit of "hands on" experience with D.school/IDEO style brainstorming and with the some tools for "user centered" product definition. The creation of "personas" is done to make it more likely that proposed designs actually attend to user's physical and psychological needs. By the end of week 2 teams should be embarked on their design process, with whatever candidate project ideas they have chosen.			

3 (19/3)	Tools for design exploration. Mapping, matrix selection. How/Why graphs. User-centric versus technology-centric. Short mapping session.		Need materials: large sheets of paper (1-2 per team) or whiteboards (1/team) and markers for brainstorming.	
(21/3)		Fabrication issues - how intended function and market determine production (and vice versa). Intro. to Critical Function and Critical Experience Prototyping (CFP and CEP).	Slides from directional adhesive fabrication. CEP and CFP intro slides, notes.	
Results	During Week 3, teams begin to explore the design and technology space associated with their chosen topics. To facilitate this activity, we introduce some representation tools, the main utility of which is to make the teams' ideas more concrete – to themselves as well as others. These tools can be used in the early stages of any design project to make concepts and connections more concrete.			
4 (4/4)	Continue CFP and CEP discussion. Requirements definition. Short hands-on brainstorming and hands-on session to identify CFP focus topics for each team.		Slides form Requirements Definition and CFP review. Need materials: quick prototyping materials available to teams for hands-on session.	
(9/4)		Wrapping it up. Design Development Proposing (who is the audience, what do they need to know?) Team coaching sessions for CFP/CEP	Need materials: quick prototyping materials available to teams for hands-on session.	
Results	In Week 4, teams are focused on identifying "critical functions" and "critical user experience" elements that could ultimately determine whether the proposed product is worth developing further. This is a first early prototyping cycle, undertaken when many details are still vague. But it builds intuition.			
5 (11/4)	CFP/CEP Bazaar -- show work in progress on the early prototypes.		Need a room with space and tables so teams can show what they are doing. If can't get enough tables for all teams, can split into two sessions I,II with half the teams in each.	
(16/4)		Final presentations of development proposals based on technology, personas, user needs, identified requirements.	This can be in a more auditorium-like space.	
Results	Teams have experienced a condensed version of what is covered in ME310a at Stanford. They have seen that a team can go very quickly from vague ideas about what a product might be to having some confidence about whether a proposed direction is reasonable and what should be done in the next steps.			

Logistics and Requirements for on hands-on sessions

Brainstorming, Personas and Requirements Definition exercises (4 sessions):
Materials: For each of these sessions, each team needs either a whiteboard and/or (preferably) a few large sheets of paper and tape. They can put the paper on a wall or table, write with markers and tape the sheets onto the wall for viewing as they complete them. Painter's masking tape is ideal. Medium large "Post It" notes are also very useful for flagging items on large drawings. One can see from the IDEO Deep Dive video how sheets and Post-Its are used.
Administration: Need a couple of people (e.g. Cutkosky + Stefanini) to go among teams encouraging them to
- get started with writing things down
- be visual (make sketches, diagrams, cartoon stick figures) whenever possible
- build on the ideas of others

Teams are encouraged to take pictures with camera phone of any diagrams.
Software: There is some useful software that can be downloaded from Tufts University:
http://vue.tufts.edu/   (or online applet at http://vue-dev.uit.tufts.edu/VUEApplet/info.cfm) The software is available for Windows/Linux/Mac and is free for academic use. It supports creating "mind maps" and directed graphs with some basic semantics. One can also attach presentation materials to a graph. The tool is useful for articulating and making concrete the relationships among subsystems and functional requirements in a design.

Hands-on prototyping and CFP/CEP preparation exercises (3 sessions):
Materials: For each of these sessions, each team needs access to some quick, rough prototyping materials. The teams can augment these materials with whatever they like. As a starting point, some of the following supplies are usually useful:
- Cardboard (sheets and/or tubes)
- Glue (paper glue and/or hot-melt glue)
- Rubber bands
- Paper clips
- "zip ties' (nylon cable ties)
- tape – masking tape or cloth reinforced tape
- string and thread
- Xacto knives or box cutters
- Access to a laser cutter?
- Wire

Administration: Need a couple of people (e.g. Cutkosky + Stefanini) to go among teams encouraging them to get started with organizing and building things and making planes for further construction after class. The idea is to start putting some rough prototypes together that can be used for the Critical Experience Prototypes and Critical Function Prototypes.