

**University Of California, Berkeley
Department of Mechanical Engineering**

ME 290P– New Product Development: Design Theory and Methods (3 units)

Graduate Course

Syllabus

CATALOG DESCRIPTION

This course is aimed at developing the interdisciplinary skills required for successful product development in today's competitive marketplace. We expect students to be disciplinary experts in their own field (e.g., engineering, business). By bringing together multiple perspectives, we will learn how product development teams can focus their efforts to quickly create cost-effective products that exceed customers' expectations.

COURSE PREREQUISITES

Graduate standing, consent of instructor.

TEXTBOOK(S) AND/OR OTHER REQUIRED MATERIAL

Reading Materials: The primary reading material for the class is the textbook *Product Design and Development* (Fifth Edition, but the Fourth edition is OK as well) written by Karl Ulrich and Steve Eppinger. This book is a very basic text that provides a step-by-step view of how new product development processes are to be conducted. Supplemental required course reading materials will also be available on bSpace or linked from our annotated outline of the fourth edition of the textbook at: <http://bit.ly/design-TOC>. Note the fifth edition has two extra chapters: Chapter 3 *Opportunity Identification* and Chapter 12 *Design for the Environment*. A copy of the fifth edition will be available at both the Haas and Engineering libraries. Most of the additional reading will be available for free on the web or through bSpace. The Le Petit Chef case study will use study.net and non-MBA students need to pay a fee to download.

COURSE OBJECTIVES

Students can expect to depart the semester understanding new product development processes as well as useful tools, techniques and organizational structures that support new product development practice.

DESIRED COURSE OUTCOMES

Students can expect to depart the semester understanding new product development processes as well as useful tools, techniques and organizational structures that support new product development practice in the context of the “triple bottom line” – economy, environment and society.

TOPICS COVERED

Product development processes and organization, product planning, high functioning teamwork, CAD/solid modeling, customer/user needs assessment, personas and empathic design, translating the "voice of

the customer", concept generation, concept selection, concept development, decision analysis, concept testing, product architectures, design for variety, design for environment, life cycle assessment, design for assembly/ manufacture, prototyping, design costing, information technologies, design optimization, universal design and entrepreneurship, innovation and intellectual property.

CLASS/LABORATORY SCHEDULE

Three hours of lecture and one hour of discussion (optional)

ASSESSMENT OF STUDENT PROGRESS TOWARD COURSE OBJECTIVES

Your course grade will be determined as follows:

- 20% on your attendance and the quality of your preparation for and participation in class discussions
- 20% on the quality of your individual assignments
- 10% for your final design journal (individual)
- 50% on the quality of your team's project-related assignments, final presentation and deliverables. The grade is distributed as follows:
 - o 20% on midterm evaluation
 - o 30% for final deliverables and final presentation to judges at final tradeshow

PERSON(S) WHO PREPARED THIS DESCRIPTION

Professor Alice Agogino

ABBREVIATED TRANSCRIPT TITLE (19 SPACES MAXIMUM): NEW PROD DEV DES TH
TIE CODE: LECT
GRADING: Letter
SEMESTER OFFERED: Fall and Spring
COURSES THAT WILL RESTRICT CREDIT: None
INSTRUCTORS: Staff
DURATION OF COURSE: 15 Weeks
EST. TOTAL NUMBER OF REQUIRED HRS OF STUDENT WORK PER WEEK: 9
IS COURSE REPEATABLE FOR CREDIT? No
CROSSLIST: None

MANAGING THE NEW PRODUCT DEVELOPMENT PROCESS:

Startups and Traditional Businesses

Alice M. Agogino and Michael Borrus

Fall 2015 ~ Version 11

TEXTBOOK AND OTHER REQUIRED MATERIAL

The primary reading material for the class is the textbook: Karl Ulrich & Steve Eppinger. *Product Design and Development*. We will be using the Fifth Edition, but the Fourth Edition is OK. However, there are 2 new chapters in the Fifth Edition (Chapter 3, “Opportunity Identification” and Chapter 12 “Design for the Environment”). A copy of the Fifth edition will be put in the Engineering Library reserve and at Haas Reserve. Most of the additional readings will be available for free on the web or through bCourses.

SCHEDULE

The schedule below provides learning goals for each session, along with required readings and individual (I) and team (T) assignments. Unless otherwise noted the individual assignments should be submitted to the appropriate class bCourses assignments link and the team assignments to the relevant folder in your project bCourses. Unless otherwise noted, ALL INDIVIDUAL ASSIGNMENTS ARE DUE BY THE BEGINNING OF CLASS ON THE DAY DUE. The team assignments labeled as “deliverables” MUST be turned in at the designated due date. Some of the team assignments are labeled as “check-ins”. These are “work in progress” team assignments to allow the teaching staff to give you feedback in class. We ask you to upload your “work in progress” on the due date, but the final could be turned in by the next class time. We have made every effort to provide you all course details in this syllabus, but we sometimes have to make changes due to unexpected circumstances, such as a change in the visit date of a guest lecturer. Please check bCourses announcements and assignment updates for changes to the schedule.

The class locations are also listed below in the schedule. Unless otherwise noted, classes will be held in the Cal Design Lab in 494 SE Wurster Hall.

<u>SESSION</u>		<u>TOPIC</u>
Tu 8/25	No Class: Non-Haas students not in session	
1 Th 8/27	Design as a Competitive Advantage for Startups and Established Businesses	
F320 Koret Room Haas	We will cover course logistics and requirements. David Blakely, former Director of Technology Strategy, IDEO, will be a guest presenter.	
Reading	Watch Video: Nightline, “The Deep Dive” (aka, “the IDEO Shopping Cart” Video) Part 1: http://www.youtube.com/watch?v=ooN05Q030Qo Part 2: http://www.youtube.com/watch?v=y_kVSJ7eAw4 Part 3: http://www.youtube.com/watch?v=fUz09EkIm64	
2 Tu 9/1	Intro to New Product Development: Design Process Models in Entrepreneurial vs. Traditional Businesses	

Cal Design Lab We will further develop the motivation and framework for the course. Be prepared to discuss why new product development is such a critical process to manage, what the key activities in new product development entail, and whether the NPD process should differ in start-up vs. traditional enterprise settings.

We'll introduce the basic structures and methodologies that are used to manage new product development in different environments. How is the process described in your book similar to/different than the process described in the "Innovation as a Learning Process" paper?

Reading Read: Sara Beckman & Michael Barry. "Innovation as a Learning Process: Embedding Design Thinking", *California Management Review*. (bCourses)
Read: John Kolko, "Design Thinking Comes of Age," Harvard Business Review, September, 2015, <https://hbr.org/2015/09/design-thinking-comes-of-age>
Read: CHAPTER. 1: "Introduction"

I-1: Individual Assignment Due **One Page Resume**
Produce a one-page resume that will be used in team activities. Submit this to the assignment tab.

3Th
9/3 **Industrial Design**

Cal Design Lab In this class we'll explore the topic of industrial design, and the role of industrial design in the new product development process. Next we will begin the process we will use to generate the project ideas for this semester's teams, document those ideas, present them to the class, identify individual project preferences and finally form project teams. Each student is to develop a project proposal. This proposal may be based on one of the bugs on the "bug list" (see individual assignment) or may be based on an unmet market need that interests the student. The proposal should be based on a *market need or bug, not on a proposed solution*.

Although the project proposals are not due until 9/8, we would like you to start thinking about ideas earlier. We strongly encourage students to submit proposals for projects they are already working on, or companies they want to start themselves. *Revolution Foods*, *PACT Apparel* and *UnderClub* were class projects, for example. Or you might consider a design project to benefit the local community. In past years, for example, teams worked on protective clothing for farm workers who handle pesticides, on emergency water supply, protection for pediatric poisoning, etc. We are happy to discuss these ideas with you ahead of time. Remember, however, that you must be able to "get out of the building" ~i.e., visit members of your target customer group, observe them and interact with them.

Reading **Scan (Steps 1-32): What is Industrial Design?** Industrial Design Society of America (IDSA), <http://www.idsa.org/education/what-is-id>
Read: "Designing for Humans: an Ethnography Primer," IDSA, 2010: <http://www.aiga.org/ethnography-primer/http://www.aiga.org/ethnography-primer/>

I-2 Individual Assignment Due **Twenty Bugs/Unmet Market Needs**
We are all capable of identifying market needs and thus generating ideas for new products, in part by noticing the deficiencies in the products we use in everyday life or by noticing something we'd really like to have that doesn't yet exist. To prove to yourself

that you can identify potential market opportunities, generate a list of at least 20 “bugs” or unmet market needs.

“Bug lists” record observations of products and situations where products failed to meet the actual conditions of use; unmet needs generally generate the thought, “It’d be great to have X when I am doing Y, but it doesn’t exist.” Your list should include any observation or annoyance that comes to your mind. Note that we are looking for a list of “bugs” (e.g., my vegetable peeler hurts my hand when I peel potatoes) and unmet needs (I’d really like to be able to stream Stream and Funny or Die while I commute to work...) rather than a list of product solutions (e.g., a vegetable peeler with a soft handle, Googlebus or self-driving, IOT-connected cars). In other words, do NOT invent solutions to the problems/needs you see – just state the problem.

Upload your list to bCourses under “assignments” and “twenty bugs”. Please either bring the physical object or a photograph or screen shot associated with at least one of your “bugs”/unmet needs to class to share with others during class.

4 Tu
9/8

Design Thinking Exercise

I-Lab This class will introduce the concepts of Double and Triple Bottom Line, which consider components beyond profit maximization that might influence an organization’s bottom line: societal benefits (often labeled “people”), and environmental impact (often: “planet”) – thus, Profits, People, Planet.

We will use waste material for a design project in a studio session today. Each student is asked to bring in two items that you find in your trash or dumpster. Or bring in something you just don’t want, but can’t figure out what to do with it. Come to class prepared to create new designs from these discards. Also make a note in your journal of what you did bring in, along with a list of other things you found but left in the trash. Consider the following thought questions: What role does technological research play in the product development process?. How is the process described in this chapter similar to/different than the process you have used in other design projects in class or work? Can design thinking be extended to a business concept as a whole? How might design thinking affect the activities of entrepreneurship?

Reading Read CHAPTER 2: “Development Processes and Organizations”
Read: Bansal, Sarika. August 21, 2014. “Innovation Within Reach,” New York Times, Opinion, <http://opinionator.blogs.nytimes.com/2014/08/21/innovation-within-reach/>
Read: Dumpster diving: an Introduction, <http://www.kuro5hin.org/story/2003/1/29/215523/088>
<http://www.kuro5hin.org/story/2003/1/29/215523/088>

I-3 Project Proposal

*Individual
Assignment Due*

Submit a one-page written proposal to the “assignments” tab, “Project Proposal”. We will move these to a folder in bCourses that is accessible for all students to view. Name it with your name and project title in the following format: “[LAST NAME], [FIRST NAME] - [PROJECT TITLE]”. For example, “Oehlberg, Lora - Spare the Air Awareness”. Your draft one-page proposals should include:

- o Brief, descriptive project title (2-4 words)
- o Your name, phone number, e-mail, and school/department affiliation
- o Description of the market opportunity you have identified. Your description may include any of the following: Documentation of the market opportunity, shortcomings of existing competitive products, and/or definition of the target market and its size. Your written descriptions should be supported by at least one photographic image, rendering or screen shot. Example:
 - o Market Opportunity ~coping with long checkout lines in grocery stores
 - o Photograph: woman standing in line, looking very bored or impatient

**5 Th
9/10 Project Proposal Presentations**

*Cal Design
Lab*

Come to class prepared to give a VERY SHORT (45 seconds with 3 slides @ 15 sec. each), yet convincing, presentation of your project proposal (i.e., an “elevator” pitch). The slides will have been compiled into a single presentation that we will run with PowerPoint’s timed presentation feature (15. sec for each slide and each student has 3 slides). UNAM (Autonomous University of Mexico) and industry-sponsored and start-up-sponsored projects may be presented as well. In order to get through all pitches in 75 min. it is important that we start on time and keep moving forward. If you are late and miss your turn, we can only allow your pitch at the end of class if there is extra time.

I-4 Proposal Presentation Slides

*Individual
Assignment Due 5:00 pm
Wed. 9/9*

Submit the slides for your project pitch under the “assignments” tab, “Project Proposal Presentation” by 5:00 pm Wed. 9/9. We will compile these slides together and make accessible for all students to view. We will compile all of the slides into a single presentation that we will run with PowerPoint’s timed presentation feature ~15 seconds per slide. Use the template provided and don’t use background images. See http://en.wikipedia.org/wiki/Pecha_Kucha for a description of this style of presentation. Your slides should communicate the following:

- The first slide MUST include your name and school/department affiliation. On this slide or the second, provide a verbal and visual demonstration of the product opportunity you have described in your proposal. Given that the audience will be able to read your written proposal at their leisure, you might spend your time explaining/demonstrating the richness of the market opportunity or show existing competitive products. Identify any special skills or assets you have related to your proposal (marketing expertise, experiences in the market, technical skills, user interface design expertise, etc.). What special skills or assets do you think you might need in other team members to complement you in developing this market opportunity?
- The LAST Slide should include a 2-4 word descriptive (and memorable) title for your proposal.

6 Tu
9/15
I-Lab

Team Launch, Team Collaborative Planning, Value Proposition

During this class session, we will talk about team dynamics and interactions as being critical to new product development success. We'll conduct a team launch exercise in which you and your teammates debrief your Kolb Learning Style profiles and the other questions on the survey. Please bring a copy of your one page resume and the Kolb Learning Style obtained earlier to class (HW-1) to use in a team launch exercise.

We will be joined by Brandi Pearce, PhD. Brandi is an expert in organizational behavior who designed and developed the Teams@Haas curriculum. During this class, we will work with your teams to help you make progress on each of the following tasks:

- Prepare your Collaboration Planning document.
- Prepare a draft Value Proposition Canvas. Use this assignment to refine the definition of your project and to agree as a team about what your objectives are, your starting customer segments, and their pain points (canvas in bSpaces). This is not cast in concrete, however, as we encourage your team to revisit every week and update.

Reading

Read: Collaborative Plan on bCourses (start on your individual plan to bring to class)

Read: "The Trouble With Teamwork",

(<http://www.hillconsultinggroup.org/assets/pdfs/articles/trouble-w-teamwork.pdf>)

T-1
Team Check-In

Team Collaborative Plan and Value Proposition Canvas

These three items should be posted to your team's bCourses.

7 Th
9/17

Product Planning and Opportunity Identification

I-Lab

How do companies decide when and how much to invest in new products and services? We will discuss techniques for product planning, including product and technology roadmaps, and advanced development. We will contrast established techniques with how denovo start-ups estimate their capital needs and size their raises. We will also cover methods for identifying and sizing market opportunities. We will discuss the pros and cons of different organizational structures and methodologies for different products and markets and for entrepreneurial vs. traditional enterprises. We will also consider the role of a design journal in the going-forward development process. Be prepared to discuss the "9 Deadly Sins" (see Reading).

Reading

Read CHAPTER 3: "Opportunity Identification" (New in Fifth Edition)

Read CHAPTER 4: "Product Planning"

Read: "The 9 Deadly Sins of the New Product Introduction Model," in Blank and Dorf, The Startup Owner's Manual, p.8-18.

8 Tu
9/22

Introduction to Customer Research Methods

I-Lab

We will introduce some techniques for identifying market opportunities, and provide an introductory overview to a range of user design research methods (e.g., observations, interviewing, focus groups, empathic design). We will also discuss methods to

communicate your user needs research within your team. Note that user needs assessment is a central theme of the so-called lean startup methodology, but, oddly, the approach never emphasizes the kinds of methodologies we describe here that could significantly improve lean startup outcomes.

Reading Read CHAPTER 5: "Identifying Customer Needs"
Read "Five Keys To Successful Design Research",
http://www.core77.com/hack2work/2009/09/five_keys_to_successful_design.asp
View "Getting People To Talk: An Ethnography And Interviewing Primer", IIT,
<http://vimeo.com/1269848>

T-2 **Draft Customer/User needs Assessment Plan**
Team Check-In During this class, we will work with your teams to help you make progress on developing a customer/user needs assessment plan (following the guidelines in CHAPTER 5) that answers the following questions:

- Who is your customer?
- How will you access your customers?
- What approach will you take to collecting information (e.g., interviews, observation, surveys)?
- What types of information will you gather?
- How will you document your information gathering (e.g., words, images)?

Upload your draft plan by the end of the day. Your goal is to learn new information about your customers and their needs ~ information beyond your original assumptions ~ by getting out of the building and interacting with them. Note that you have an individual assignment to complete a customer interview by Thursday, September 24. You may wish to coordinate who you will interview at this meeting.

9 Th **Customer Research: Observations & Interviews**
9/24

Cal Design Lab We will talk about user needs understanding, and in particular the role of ethnographic research in understanding customer needs.

Reading **Read: "Get Inside the Lives of Your Customers" on bCourses.**
Read "An introduction to personas and how to create them",
http://www.steptwo.com.au/papers/kmc_personas/index.html
Read "Consumer Insight Maps: The Map As Story Platform In The Design Process",
http://piim.newschool.edu/journal/issues/2011/01/pdfs/ParsonsJournalForInformationMapping_Erwin-Kim.pdf

I-5 **Customer/User Needs Interview**
Individual Assignment Due Choose a product that competes with or serves a similar purpose to the one your project team is developing. Interview a potential or current user of the product about what they like and dislike about the product. This interview can be done very informally in 5-10 minutes.

Record what your interviewee says and interpret the data in terms of customer needs using the methods in Chapter 5, Exhibit 5-6. Pay particular attention to the guidelines provided for translating customer statements into needs statements. Prepare a one-page summary of what you have learned about the interview process.

Submit both the written interview record and a one-page summary of the customer needs

formally extracted from the interviews to the assignments tab under “Customer Interview.”

10 Tu **Customer Validation and Methods in a Start-up Context**

09/29

*Cal Design
Lab*

Guest: Amanda Bradford, Founder and CEO, The League

Startups operate with different time frame, goals and resources than established businesses. How do the kinds of techniques we’ve examined the past few weeks play out in the real world of Startups? We will be joined by Amanda Bradford, founder of hot dating startup, The League, who will take us through the methods her team has used and the learning they’ve gleaned from on-going customer validation efforts.

Reading Read: “The League, a Dating App for Would-be Power Couples,” New York Times, January 23, 2015

http://www.nytimes.com/2015/01/25/style/the-league-a-boutique-approach-among-dating-apps.html?_r=0

Read: Steve Blank’s lecture slides on Tactics for Discovery of Customer Discovery. These slides are intended for his workshops, but have tactical approaches that complement our lectures as well, <http://www.slideshare.net/sblank/customer-discovery-23251533?related=1>

*I-6
Individual
Assignment
Due*

Benchmarking

Please individually identify 1-2 solutions that compete with your potential solution to solve the same customer/user needs – if your needs are currently unmet, choose the closest analogues you can think of – if you had a silver bullet to kill 1-2 competitors, who would you kill? Bring information about each of them to the class session to share with your teammates and use in the framing/reframing exercises. Also upload to bCourses to get assignment credit.

11 Th

10/1

*Cal Design
Lab*

Customer Research and Data-Driven Business Models

We’ll use this class time to take a step back and look at the broader picture of how NPD relates to different kinds of business models, especially in an era being transformed by so-called Big Data and computation. What is the purpose of a business model? What’s the relationship between NPD efforts and business models? We’ll use modern Big Data businesses, especially those that rely on continuous extraction and parsing of customer data, to guide our discussion.

Reading **Read:** Business Model Canvas, <http://www.businessmodelgeneration.com/canvas>

12 Tu

10/6

*Cal Design
Lab*

Customer Research: Prioritizing Needs & Design Imperatives

We jump back into your customer research this week. We will present different ways of analyzing and prioritizing customer and user needs data in order to translate the “Voice of the Customer” into imperatives, principles and specifications. The Kano model will be presented to help prioritize needs.

Reading Read “Turn Customer Input Into Innovation”, bCourses or <https://hbr.org/2002/01/turn-customer-input-into-innovation>

T-3 Updated Customer/ User Needs Assessment Plan

Team Check-In Also include a short (1/2 page) discussion of the process you used, lessons learned, and any observations you have about your team. Submit these to your group's project site on bCourses.

13Th Customer Research: Translating the Voice of the Customer

10/8

Cal Design
Lab

In this class we will move a little ahead of where your project should be to introduce you to the next step of the process ~ translating customer and user needs information into design specifications. We'll introduce the basic concepts of specification development, including Quality Function Deployment, and then have you do some exercises with your project data to play with the concepts. A guest speaker from the start-up world will provide a case study.

Reading Read CHAPTER 6: “Product Specifications”

14 Tu In-Class Peer Review: Customer Needs Research

10/13

I-Lab

This will be the first of three peer reviews you will have on your product development project. During class we will pair you up with other teams to present and give feedback to one another. Come prepared to share: 1) your mission statement, as is shown in your textbook, 2) a brief review of the means used to collect customer and user needs information, 3) a summary of the identified customer and user needs, 4) one of your most interesting use scenarios, and 5) a summary of lessons learned in the process to date. This is an opportunity to receive feedback from and give feedback to your classmates. It is also an opportunity to learn about new product development processes by observing what others have done on and learned from their projects.

T4 Team Deliverable	Updated Business Proposition Canvas, Customer/User Needs Analysis with Progress (to date), Interview Debrief Sheets and Lessons Learned & Team Observations
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Due Your project should now have completed a first pass at the following activities: Gathered raw data on customer needs (through whatever means you deem most appropriate to your potential market); Generated a list of customer needs for your product and organized it hierarchically into primary, secondary and tertiary needs as described in your book; Identified three or four needs that you feel are important, but latent and not addressed by current products.

Your Value Proposition Canvas and Assessment Plan should continue to evolve throughout the product development process as you learn more about your target market and gather feedback from faculty and others. You should continue to update these documents as you gather new inputs (archiving the old ones on the Web site).

15Th Concept Generation: Creativity & Brainstorming

10/15

Cal Design
Lab

This class session will focus on brainstorming and “ideation” techniques used by new product development teams to generate product ideas from their understanding of customer wants and needs and of the available technologies.

We'll briefly review some of the commonly used techniques, and will then engage you in processing the concepts you've already generated, and in creating more within your teams.

Reading Read CHAPTER 7: "Concept Generation"

Read "Creative Thinking Techniques" (<http://www.virtualsalt.com/crebook2.htm>)

Scan: Ideation Methods theDesignExchange: <https://www.thedesignexchange.org/>

I-7 Generate 10 Concepts

Individual Assignment Due 10/15 Research has shown that more concepts are generated if team members first generate their own concepts prior to meeting in a team brainstorming session. Using the half-sheet form posted with the bCourses assignment, submit 10 individual concepts, post to your project folder (but don't look at the others yet) and bring to class in preparation for the team exercise.

16 Tu 10/20 Concept Generation: Structured Method

I-Lab This class will focus on structured methods for concept generation, such as Morphological Matrices, Functional Decomposition, Biomimetic Design, etc.

Reading Read "Morphological Charts",

<http://www.ifm.eng.cam.ac.uk/dmg/tools/concept/morph.html>

Scan "Creax Function Database", <http://function.creax.com/>

Scan "Biomimicry Institute", <http://www.biomimicryinstitute.org/> This class will focus on structured methods for concept generation, such as Morphological Matrices, Functional Decomposition, Biomimetic Design, etc.

T-5 Expansion of Concept Generation

Team Check-In After reviewing your teams' original 10 individual concepts, double the number through brainstorming and structured methods (e.g., for a team of 5, you should strive for a total of 100 concepts). After class in your next team meeting, expand your concepts using both brainstorming and structured methods and update your spreadsheet with the new concepts generated. Upload to bCourses before the next class.

17 Th 10/22 Concept Selection

Cal Design Lab Once you have generated a set of possible product concepts, you must identify the one or ones that you will actually work on. During this class session, we review methodologies for choosing from among the options, again drawing contrasts with start-up methods. During class, you'll work in your teams to apply the methods of this chapter to your projects.

Reading Read CHAPTER 8: "Concept Selection"

I-8 Concept Selection Criteria

Individual Assignment Due CHAPTER 8 describes concept screening and concept scoring matrices as a means of selecting among competing ideas for products you might develop. In concept selection, you will need to be clear about the criteria you are using to evaluate your concepts. Create a list of the top 7-10 selection criteria that you believe should be applied in the selection of the concepts you will further develop in class. Write each criterion on a Post-it note and bring it to class use in our concept selection exercises.

T-6 Team Concept Selection

- Team Check-In* In class, we will work on an exercise to select your top 10 product concepts from all the ones generated in the prior classes. Submit your 10 selections to your project bCourses folder by the end of the day or after your next team meeting (just make sure it is submitted before class on 10/27). Submit a team “lessons learned” document.
- 18 Tu 10/27 Prototyping: Lo-Fidelity**
- I-Lab* We will introduce tools and techniques for prototyping and testing your product concepts. Bring to class discarded items that would normally go to landfill to use as prototyping materials. Anything goes!
- Reading* **Read: “Prototyping Is The Shorthand Of Design”,**
http://www.ideo.com/images/uploads/news/pdfs/Kelley-Prototyping_Shorthand_DesignSummer-01.pdf
http://www.ideo.com/images/uploads/news/pdfs/Kelley-Prototyping_Shorthand_DesignSummer-01.pdf
Read: Sandhu, Jaspal S. “Measure early, measure often: rapid, real-time feedback in design for social innovation”. Jan. 2013:
http://poptech.org/e3_jaspal_sandhu
http://poptech.org/e3_jaspal_sandhu
- T-7 Team Check-In* **Prototype Photographs**
 Submit photographs/digital screenshots of any prototypes you create in-class by end of day.
- 19 Th 10/29 Prototyping: Concept Testing**
- Cal Design Lab* Concept testing should be done throughout the new product development process. This class will introduce various techniques that can be used at different stages.
- Reading* Read CHAPTER. 9: “Concept Testing”
 Read “Extremely Rapid Usability Testing”,
<http://grouplab.cpsc.ucalgary.ca/grouplab/uploads/Publications/Publications/2009-ERUT.JUS.pdf>) to get ideas as to how you can best use the time you will have with your fellow students in the In-Class Midterm Tradeshow on 11/3.
- T-8 Team Deliverable Due* **Project Deliverables (due Monday 11/2 by 5 p.m.)**
1. Prepare a THREE-SLIDE summary of your:
 - a. Mission statement
 - b. Target market
 - c. Salient customer needs
- Plan to orally present this one page summary briefly at the beginning of the class on Tuesday 11/3 in 3 slides in 1 minute: 20 seconds per slide. Submit the slides to the class GSI no later than 5p.m. on Monday, November 2. We’ll follow the same presentation format that we used in the proposal presentations. This will bring the entire class up to speed on your project before they review your work.
- 20 Tu 11/3 Midterm Trade Show Peer Review: 3 Concepts & Prototypes**
- I-Lab* **Session objectives:**
- o Update your classmates as to progress on your product development effort.
 - o Make the first “public” presentation of your “proof-of-concept ideas”.

- o Gather feedback from classmates on your concept design and mockups using concept-testing techniques.

From this point forward, your focus will be on developing and testing your product concept with your customer base, obtaining feedback, incorporating it into your product, and preparing intermediate and final product prototypes.

- T-9 Midterm Trade Show Deliverables**
- Team Deliverable Due*
1. The three slides you submitted on 11/2.
 2. Prepare your "proof-of-concept" sketches, product renderings and early prototypes so that everyone can understand your ideas. After the brief review at the beginning of the class, we will spend about 50 minutes in a "tradeshow" environment during which you will wander around the classroom to look at the other work. You are welcome to bring portable computers to set up your images. You should plan to handle any arrangements for using computers on your own.
 3. To support your concepts, you should have the following materials available. (Each team will likely have done different versions of these. Use what you have already developed.)
 - a. Customer/user needs hierarchy
 - b. Mapping of customer needs to specifications
 - c. Concept sketches
 - d. Product renderings or mockups (3D renderings, early physical or web mockups or screenshots)
 - e. Concept screening and scoring matrices
 - f. Reason for choosing the concept(s) you have developed for today

As we will only have about 50 minutes for this session, you should plan to have group members rotate responsibility for showing the concepts so that other group members can circulate. Think about the best way to efficiently and effectively collect feedback from your classmates. You may wish to have a mini-survey available for them to complete. Remember that each student reviewer will only have about 5 minutes to spend reviewing your work; so make your presentation as succinct as possible.

Be sure to upload all of these documents to your project bCourses, along with "lessons learned". Use the "DEL-Midterm" Folder.

- I-9 360 Peer Review and Team Process Survey**
- Individual Assignment Due*
- Complete the on-line peer review and team process survey. This will be emailed to directly to you today and **MUST** be completed by (11/5) 11:59pm for us to be able to provide feedback to your entire team next week.

- 21 Th 11/5 Medium and High Fidelity Prototyping**
- Cal Design Lab Reading*
- Review of medium and high fidelity prototyping methods. Alpha and Beta testing of software; forward and backward software compatibility. *In-class exercise:* Prototyping lab. Review Ch. 14: Prototyping

- 22 Tu 11/10 Team Process Check-In**
- I-Lab*
- This class session will be dedicated to giving your team an opportunity to reflect on your team dynamics. You will have the opportunity to leverage the findings from the team

process survey in your Collaborative Mapping session -- a technique designed to facilitate a team discussion in which you work together to identify your team's strengths as well as opportunities for adaptation. The primary goal of today's class is to give you an opportunity to reflect on your team processes, strategies and objectives to enhance your team's overall effectiveness in leveraging the diverse multi-disciplinary knowledge that resides in your team. Brandi Pearce, PhD from Teams@Haas will again join us.

**23 Th
11/12** **Product Architectures and More Business Models**

Cal Design Lab In this class, we extend our earlier business model discussions to product architectures and product platforms. In so doing, we will touch on all of the elements of the business model canvas developed for lean start-up methodology. Then, in an in-class exercise, you will develop your own rough business model using the business model canvas.

Reading Read CHAPTER 10: "Product Architecture"
Read "Business Model Canvas," <http://www.businessmodelhub.com/page/business-model-canvas>

**24 Tu
11/17** **Design for X: Design for Production and the Environment**

I-Lab Our "Design for X" sequence will cover design for the environment (DfE) and/or manufacture (DfM) as an example of design for production (DfP -- similar concepts have been applied to software and services). In this class session we'll cover more detailed issues of life cycle analysis and detailed design guidelines. Product costing will be covered in the next class.

Consider the following thought questions:

- How might you make tradeoffs among cost, quality, features and environmental soundness when designing a product?
- What are the steps in a "Cradle to Grave" life cycle assessment?
- What is the difference between the "cradle to grave" perspective and the "cradle to cradle" alternative?
- How might product architecture affect your DfE strategy?
- Are there any conflicts between DfM and DfE design guidelines?
- How might your DfM strategy vary with the production size of your product?

Reading Read CHAPTER 12: "Design For Environment" (new chapter in fifth edition)
Read CHAPTER 13: "Design For Manufacturing"
Read: from bCourses: Kambrook Kettle case study: "Mainstream appliance meets eco-design" (*Journal of Sustainable Product Design*)
Read: Lifecycle Assessment Primer by Jer Faludi and Adam Mentor,
http://faludidesign.com/MCAD_images/LCA_Primer_Autodesk-SWorkshop_Final.pdf

**25 Th
11/19** **Product Economics and Product Portfolio Management**

Cal Design Lab We'll share a spreadsheet that has been set up for you to use to develop the financials for the business case for your projects, and then lead you through an in-class exercise. We will place the business case for a single project within a larger product portfolio strategy.

Reading Read CHAPTER 17: "Product Development Economics"

T-10 Business Model Canvas

<i>Team Check-In</i>	Submit your team's business model canvas to your project bCourses. Include an updated mission statement (full one pager) and "lessons learned" as well. Complete your 360 Peer Review and Team Process Survey by today.
26 Tu 11/24	Successful Product Development Case Study: SideCar <i>Guest Lecture: Sunil Paul, CEO, SideCar (tbc)</i>
<i>I-Lab</i>	We will have an in-class discussion of SideCar, a startup playing at the leading edge of the emerging digital, data-driven share economy. We will be joined by SideCar's CEO, Sunil Paul, a serial entrepreneur with several startups under his belt, who will share both his product development experience with SideCar and his observations about how entrepreneurship is changing in the current.
<i>Reading</i>	Read TBD
Th 11/26	Thanksgiving. No class
27 T 12/1	Communication, Feedback on Presentations
<i>I-Lab</i>	As you approach the end of the semester, you should start thinking about how you will communicate your project outcomes to the judges who will be present at the final tradeshow. In this session we'll review good presentation and storytelling techniques, and let you start practicing applying them to your projects. We will use the last two class sessions to let you work on preparing your materials for the final tradeshow event. The faculty, your fellow students, and possibly some guest speakers will be available to go through your materials with you and help you formulate them for the final tradeshow.
<i>Reading</i>	Read: CHAPTER 1, "What Sticks?" In Made To Stick", http://www.madetostick.com/excerpts/
28 Th 12/3	Course Overview: Lessons Learned and Final Deliverables
<i>Cal Design Lab</i>	We will spend this class session sharing lessons learned and synthesizing those lessons across the projects.
<i>I-10 Individual Assignment Due</i>	Reflect on the experience you have had working with your team in developing your product this semester. Capture 8 ~10 key lessons you have learned from the experience. Write them up and submit them to the "assignments" tab under "lessons learned. In addition, transcribe each of them onto a post-it note (one per post-it). Bring those notes to class with you to share.
29 Tu 12/8 (I-Lab) I-Lab	Review: Feedback on Presentations/ Final Deliverables The teaching staff and guests will provide final review and feedback prior to the trade show on Saturday.
30 Sa 12/12	FINAL TRADESHOW Saturday, December 12, 1-4 p.m. (set-up time earlier) Wells Fargo Room, Haas School of Business

During the tradeshow, you will have the opportunity to display your product prototype to your peers, course faculty, the design coaches and a group of invited judges and guests. (Space reserved from 11:00 am ~5 pm.)

Attendance at the final tradeshow is MANDATORY as it is considered the “final” for the class.

Prepare a 10-minute presentation that describes your final product that will convince the judges that there is a viable market for your product, and that your proposed solution will be successful in that market. Remember that most of the judges will not be familiar with your project at all, never having seen any of your previous work, so you have to tell them a story about why there’s a need, how you focused on the customer to discover the detailed needs, and how you benchmarked and explored a wide range of potential solutions to come up with the best product.

The presentation should be of the quality to convince a top management group to purchase the rights to your product or a venture firm to fund its development and launch. An effective presentation includes a slide presentation along with a display of a working prototype. Be sure to include all areas covered in the judging form (to be posted on bCourses). Typical questions a judge might want answered.

- o How did you come up with this idea?
- o Who are the competitors and what products are out there now?
- o What need or needs are lacking in the current products out there?
- o Is there a large enough market for your product to make it successful?
- o Define what success is – financial, societal, environmental, etc.
- o What are your costs and can you make a reasonable profit, or if a non-profit, is it viable financially?
- o What ideas did you discard, and will your final product idea meet the customer needs?
- o What made you decide on that idea?

I-11 Complete the Team Evaluation Survey

Individual Assignment Use the same procedure as with the mid-term team evaluation survey.

I-12 Design journal

Individual Assignment Submit at the trade show. They will be returned the following week or at the beginning of the Spring semester upon request.

T-11 FINAL TEAM DELIVERABLES

Team Deliverable Due Submit in SINGLE FOLDER titled Final Deliverable in your project bCourses. Your final deliverables include:

1. Final mission statement
2. Final customer user needs assessment including whatever frames, personas, scenarios etc. you used, as well as a summary of who you interviewed, interview guides, example notes from interviews, focus groups, surveys, etc. You’ve done a lot of work in this area, so give us a concise yet convincing glimpse into your efforts.
3. Concept generation sketches, showing the breadth of concepts you generated throughout the semester

4. Concept selection matrices, particularly that highlight how you got to your final concept
5. Concept testing results and how those results affected your final design choices
6. Financial analysis, business model and triple bottom line considerations
7. A photo of your final prototype. We may ask to keep some of your prototypes, but cannot keep them all, so please submit a photo of the final solution
8. Copy of your presentation slides.

MANAGING THE NEW PRODUCT DEVELOPMENT PROCESS:

Startups and Traditional Businesses

Alice M. Agogino and Michael Borrus

Fall 2015 ~ Version 11

TEXTBOOK AND OTHER REQUIRED MATERIAL

The primary reading material for the class is the textbook: Karl Ulrich & Steve Eppinger. *Product Design and Development*. We will be using the Fifth Edition, but the Fourth Edition is OK. However, there are 2 new chapters in the Fifth Edition (Chapter 3, “Opportunity Identification” and Chapter 12 “Design for the Environment”). A copy of the Fifth edition will be put in the Engineering Library reserve and at Haas Reserve. Most of the additional readings will be available for free on the web or through bCourses.

SCHEDULE

The schedule below provides learning goals for each session, along with required readings and individual (I) and team (T) assignments. Unless otherwise noted the individual assignments should be submitted to the appropriate class bCourses assignments link and the team assignments to the relevant folder in your project bCourses. Unless otherwise noted, ALL INDIVIDUAL ASSIGNMENTS ARE DUE BY THE BEGINNING OF CLASS ON THE DAY DUE. The team assignments labeled as “deliverables” MUST be turned in at the designated due date. Some of the team assignments are labeled as “check-ins”. These are “work in progress” team assignments to allow the teaching staff to give you feedback in class. We ask you to upload your “work in progress” on the due date, but the final could be turned in by the next class time. We have made every effort to provide you all course details in this syllabus, but we sometimes have to make changes due to unexpected circumstances, such as a change in the visit date of a guest lecturer. Please check bCourses announcements and assignment updates for changes to the schedule.

The class locations are also listed below in the schedule. Unless otherwise noted, classes will be held in the Cal Design Lab in 494 SE Wurster Hall.

<u>SESSION</u>		<u>TOPIC</u>
Tu 8/25	No Class: Non-Haas students not in session	
1 Th 8/27	Design as a Competitive Advantage for Startups and Established Businesses	
F320 Koret Room Haas	We will cover course logistics and requirements. David Blakely, former Director of Technology Strategy, IDEO, will be a guest presenter.	
Reading	Watch Video: Nightline, “The Deep Dive” (aka, “the IDEO Shopping Cart” Video) Part 1: http://www.youtube.com/watch?v=ooN05Q030Qo Part 2: http://www.youtube.com/watch?v=y_kVSJ7eAw4 Part 3: http://www.youtube.com/watch?v=fUz09EkIm64	
2 Tu 9/1	Intro to New Product Development: Design Process Models in Entrepreneurial vs. Traditional Businesses	

Cal Design Lab We will further develop the motivation and framework for the course. Be prepared to discuss why new product development is such a critical process to manage, what the key activities in new product development entail, and whether the NPD process should differ in start-up vs. traditional enterprise settings.

We'll introduce the basic structures and methodologies that are used to manage new product development in different environments. How is the process described in your book similar to/different than the process described in the "Innovation as a Learning Process" paper?

Reading Read: Sara Beckman & Michael Barry. "Innovation as a Learning Process: Embedding Design Thinking", *California Management Review*. (bCourses)
Read: John Kolko, "Design Thinking Comes of Age," Harvard Business Review, September, 2015, <https://hbr.org/2015/09/design-thinking-comes-of-age>
Read: CHAPTER. 1: "Introduction"

I-1: Individual Assignment Due **One Page Resume**
Produce a one-page resume that will be used in team activities. Submit this to the assignment tab.

3Th
9/3 **Industrial Design**

Cal Design Lab In this class we'll explore the topic of industrial design, and the role of industrial design in the new product development process. Next we will begin the process we will use to generate the project ideas for this semester's teams, document those ideas, present them to the class, identify individual project preferences and finally form project teams. Each student is to develop a project proposal. This proposal may be based on one of the bugs on the "bug list" (see individual assignment) or may be based on an unmet market need that interests the student. The proposal should be based on a *market need or bug, not on a proposed solution*.

Although the project proposals are not due until 9/8, we would like you to start thinking about ideas earlier. We strongly encourage students to submit proposals for projects they are already working on, or companies they want to start themselves. *Revolution Foods*, *PACT Apparel* and *UnderClub* were class projects, for example. Or you might consider a design project to benefit the local community. In past years, for example, teams worked on protective clothing for farm workers who handle pesticides, on emergency water supply, protection for pediatric poisoning, etc. We are happy to discuss these ideas with you ahead of time. Remember, however, that you must be able to "get out of the building" ~i.e., visit members of your target customer group, observe them and interact with them.

Reading **Scan (Steps 1-32): What is Industrial Design?** Industrial Design Society of America (IDSA), <http://www.idsa.org/education/what-is-id>
Read: "Designing for Humans: an Ethnography Primer," IDSA, 2010: <http://www.aiga.org/ethnography-primer/http://www.aiga.org/ethnography-primer/>

I-2 Individual Assignment Due **Twenty Bugs/Unmet Market Needs**
We are all capable of identifying market needs and thus generating ideas for new products, in part by noticing the deficiencies in the products we use in everyday life or by noticing something we'd really like to have that doesn't yet exist. To prove to yourself

that you can identify potential market opportunities, generate a list of at least 20 “bugs” or unmet market needs.

“Bug lists” record observations of products and situations where products failed to meet the actual conditions of use; unmet needs generally generate the thought, “It’d be great to have X when I am doing Y, but it doesn’t exist.” Your list should include any observation or annoyance that comes to your mind. Note that we are looking for a list of “bugs” (e.g., my vegetable peeler hurts my hand when I peel potatoes) and unmet needs (I’d really like to be able to stream Stream and Funny or Die while I commute to work...) rather than a list of product solutions (e.g., a vegetable peeler with a soft handle, Googlebus or self-driving, IOT-connected cars). In other words, do NOT invent solutions to the problems/needs you see – just state the problem.

Upload your list to bCourses under “assignments” and “twenty bugs”. Please either bring the physical object or a photograph or screen shot associated with at least one of your “bugs”/unmet needs to class to share with others during class.

4 Tu
9/8

Design Thinking Exercise

I-Lab This class will introduce the concepts of Double and Triple Bottom Line, which consider components beyond profit maximization that might influence an organization’s bottom line: societal benefits (often labeled “people”), and environmental impact (often: “planet”) – thus, Profits, People, Planet.

We will use waste material for a design project in a studio session today. Each student is asked to bring in two items that you find in your trash or dumpster. Or bring in something you just don’t want, but can’t figure out what to do with it. Come to class prepared to create new designs from these discards. Also make a note in your journal of what you did bring in, along with a list of other things you found but left in the trash. Consider the following thought questions: What role does technological research play in the product development process?. How is the process described in this chapter similar to/different than the process you have used in other design projects in class or work? Can design thinking be extended to a business concept as a whole? How might design thinking affect the activities of entrepreneurship?

Reading Read CHAPTER 2: “Development Processes and Organizations”
Read: Bansal, Sarika. August 21, 2014. “Innovation Within Reach,” New York Times, Opinion, <http://opinionator.blogs.nytimes.com/2014/08/21/innovation-within-reach/>
Read: Dumpster diving: an Introduction, <http://www.kuro5hin.org/story/2003/1/29/215523/088>
<http://www.kuro5hin.org/story/2003/1/29/215523/088>

I-3 Project Proposal

*Individual
Assignment Due*

Submit a one-page written proposal to the “assignments” tab, “Project Proposal”. We will move these to a folder in bCourses that is accessible for all students to view. Name it with your name and project title in the following format: “[LAST NAME], [FIRST NAME] - [PROJECT TITLE]”. For example, “Oehlberg, Lora - Spare the Air Awareness”. Your draft one-page proposals should include:

- o Brief, descriptive project title (2-4 words)
- o Your name, phone number, e-mail, and school/department affiliation
- o Description of the market opportunity you have identified. Your description may include any of the following: Documentation of the market opportunity, shortcomings of existing competitive products, and/or definition of the target market and its size. Your written descriptions should be supported by at least one photographic image, rendering or screen shot. Example:
 - o Market Opportunity ~coping with long checkout lines in grocery stores
 - o Photograph: woman standing in line, looking very bored or impatient

**5 Th
9/10 Project Proposal Presentations**

*Cal Design
Lab*

Come to class prepared to give a VERY SHORT (45 seconds with 3 slides @ 15 sec. each), yet convincing, presentation of your project proposal (i.e., an “elevator” pitch). The slides will have been compiled into a single presentation that we will run with PowerPoint’s timed presentation feature (15. sec for each slide and each student has 3 slides). UNAM (Autonomous University of Mexico) and industry-sponsored and start-up-sponsored projects may be presented as well. In order to get through all pitches in 75 min. it is important that we start on time and keep moving forward. If you are late and miss your turn, we can only allow your pitch at the end of class if there is extra time.

I-4 Proposal Presentation Slides

*Individual
Assignment Due 5:00 pm
Wed. 9/9*

Submit the slides for your project pitch under the “assignments” tab, “Project Proposal Presentation” by 5:00 pm Wed. 9/9. We will compile these slides together and make accessible for all students to view. We will compile all of the slides into a single presentation that we will run with PowerPoint’s timed presentation feature ~15 seconds per slide. Use the template provided and don’t use background images. See http://en.wikipedia.org/wiki/Pecha_Kucha for a description of this style of presentation. Your slides should communicate the following:

- The first slide MUST include your name and school/department affiliation. On this slide or the second, provide a verbal and visual demonstration of the product opportunity you have described in your proposal. Given that the audience will be able to read your written proposal at their leisure, you might spend your time explaining/demonstrating the richness of the market opportunity or show existing competitive products. Identify any special skills or assets you have related to your proposal (marketing expertise, experiences in the market, technical skills, user interface design expertise, etc.). What special skills or assets do you think you might need in other team members to complement you in developing this market opportunity?
- The LAST Slide should include a 2-4 word descriptive (and memorable) title for your proposal.

6 Tu
9/15
I-Lab

Team Launch, Team Collaborative Planning, Value Proposition

During this class session, we will talk about team dynamics and interactions as being critical to new product development success. We'll conduct a team launch exercise in which you and your teammates debrief your Kolb Learning Style profiles and the other questions on the survey. Please bring a copy of your one page resume and the Kolb Learning Style obtained earlier to class (HW-1) to use in a team launch exercise.

We will be joined by Brandi Pearce, PhD. Brandi is an expert in organizational behavior who designed and developed the Teams@Haas curriculum. During this class, we will work with your teams to help you make progress on each of the following tasks:

- Prepare your Collaboration Planning document.
- Prepare a draft Value Proposition Canvas. Use this assignment to refine the definition of your project and to agree as a team about what your objectives are, your starting customer segments, and their pain points (canvas in bSpaces). This is not cast in concrete, however, as we encourage your team to revisit every week and update.

Reading

Read: Collaborative Plan on bCourses (start on your individual plan to bring to class)

Read: "The Trouble With Teamwork",

(<http://www.hillconsultinggroup.org/assets/pdfs/articles/trouble-w-teamwork.pdf>)

T-1
Team Check-
In

Team Collaborative Plan and Value Proposition Canvas

These three items should be posted to your team's bCourses.

7 Th
9/17

Product Planning and Opportunity Identification

I-Lab

How do companies decide when and how much to invest in new products and services? We will discuss techniques for product planning, including product and technology roadmaps, and advanced development. We will contrast established techniques with how denovo start-ups estimate their capital needs and size their raises. We will also cover methods for identifying and sizing market opportunities. We will discuss the pros and cons of different organizational structures and methodologies for different products and markets and for entrepreneurial vs. traditional enterprises. We will also consider the role of a design journal in the going-forward development process. Be prepared to discuss the "9 Deadly Sins" (see Reading).

Reading

Read CHAPTER 3: "Opportunity Identification" (New in Fifth Edition)

Read CHAPTER 4: "Product Planning"

Read: "The 9 Deadly Sins of the New Product Introduction Model," in Blank and Dorf, The Startup Owner's Manual, p.8-18.

8 Tu
9/22

Introduction to Customer Research Methods

I-Lab

We will introduce some techniques for identifying market opportunities, and provide an introductory overview to a range of user design research methods (e.g., observations, interviewing, focus groups, empathic design). We will also discuss methods to

communicate your user needs research within your team. Note that user needs assessment is a central theme of the so-called lean startup methodology, but, oddly, the approach never emphasizes the kinds of methodologies we describe here that could significantly improve lean startup outcomes.

Reading Read CHAPTER 5: "Identifying Customer Needs"
Read "Five Keys To Successful Design Research",
http://www.core77.com/hack2work/2009/09/five_keys_to_successful_design.asp
View "Getting People To Talk: An Ethnography And Interviewing Primer", IIT,
<http://vimeo.com/1269848>

T-2 **Draft Customer/User needs Assessment Plan**
Team Check-In During this class, we will work with your teams to help you make progress on developing a customer/user needs assessment plan (following the guidelines in CHAPTER 5) that answers the following questions:

- Who is your customer?
- How will you access your customers?
- What approach will you take to collecting information (e.g., interviews, observation, surveys)?
- What types of information will you gather?
- How will you document your information gathering (e.g., words, images)?

Upload your draft plan by the end of the day. Your goal is to learn new information about your customers and their needs ~ information beyond your original assumptions ~ by getting out of the building and interacting with them. Note that you have an individual assignment to complete a customer interview by Thursday, September 24. You may wish to coordinate who you will interview at this meeting.

9 Th **Customer Research: Observations & Interviews**
9/24

Cal Design Lab We will talk about user needs understanding, and in particular the role of ethnographic research in understanding customer needs.

Reading **Read: "Get Inside the Lives of Your Customers" on bCourses.**
Read "An introduction to personas and how to create them",
http://www.steptwo.com.au/papers/kmc_personas/index.html
Read "Consumer Insight Maps: The Map As Story Platform In The Design Process",
http://piim.newschool.edu/journal/issues/2011/01/pdfs/ParsonsJournalForInformationMapping_Erwin-Kim.pdf

I-5 **Customer/User Needs Interview**
Individual Assignment Due Choose a product that competes with or serves a similar purpose to the one your project team is developing. Interview a potential or current user of the product about what they like and dislike about the product. This interview can be done very informally in 5-10 minutes.

Record what your interviewee says and interpret the data in terms of customer needs using the methods in Chapter 5, Exhibit 5-6. Pay particular attention to the guidelines provided for translating customer statements into needs statements. Prepare a one-page summary of what you have learned about the interview process.

Submit both the written interview record and a one-page summary of the customer needs

formally extracted from the interviews to the assignments tab under “Customer Interview.”

10 Tu **Customer Validation and Methods in a Start-up Context**

09/29

*Cal Design
Lab*

Guest: Amanda Bradford, Founder and CEO, The League

Startups operate with different time frame, goals and resources than established businesses. How do the kinds of techniques we’ve examined the past few weeks play out in the real world of Startups? We will be joined by Amanda Bradford, founder of hot dating startup, The League, who will take us through the methods her team has used and the learning they’ve gleaned from on-going customer validation efforts.

Reading Read: “The League, a Dating App for Would-be Power Couples,” New York Times, January 23, 2015

http://www.nytimes.com/2015/01/25/style/the-league-a-boutique-approach-among-dating-apps.html?_r=0

Read: Steve Blank’s lecture slides on Tactics for Discovery of Customer Discovery. These slides are intended for his workshops, but have tactical approaches that complement our lectures as well, <http://www.slideshare.net/sblank/customer-discovery-23251533?related=1>

*I-6
Individual
Assignment
Due*

Benchmarking

Please individually identify 1-2 solutions that compete with your potential solution to solve the same customer/user needs – if your needs are currently unmet, choose the closest analogues you can think of – if you had a silver bullet to kill 1-2 competitors, who would you kill? Bring information about each of them to the class session to share with your teammates and use in the framing/reframing exercises. Also upload to bCourses to get assignment credit.

11 Th **Customer Research and Data-Driven Business Models**

10/1

*Cal Design
Lab*

We’ll use this class time to take a step back and look at the broader picture of how NPD relates to different kinds of business models, especially in an era being transformed by so-called Big Data and computation. What is the purpose of a business model? What’s the relationship between NPD efforts and business models? We’ll use modern Big Data businesses, especially those that rely on continuous extraction and parsing of customer data, to guide our discussion.

Reading **Read:** Business Model Canvas, <http://www.businessmodelgeneration.com/canvas>

12 Tu **Customer Research: Prioritizing Needs & Design Imperatives**

10/6

*Cal Design
Lab*

We jump back into your customer research this week. We will present different ways of analyzing and prioritizing customer and user needs data in order to translate the “Voice of the Customer” into imperatives, principles and specifications. The Kano model will be presented to help prioritize needs.

Reading Read “Turn Customer Input Into Innovation”, bCourses or <https://hbr.org/2002/01/turn-customer-input-into-innovation>

T-3 Team Check- In	Updated Customer/ User Needs Assessment Plan Also include a short (1/2 page) discussion of the process you used, lessons learned, and any observations you have about your team. Submit these to your group's project site on bCourses.
13Th 10/8 Cal Design Lab Reading	Customer Research: Translating the Voice of the Customer In this class we will move a little ahead of where your project should be to introduce you to the next step of the process ~ translating customer and user needs information into design specifications. We'll introduce the basic concepts of specification development, including Quality Function Deployment, and then have you do some exercises with your project data to play with the concepts. A guest speaker from the start-up world will provide a case study. Read CHAPTER 6: "Product Specifications"
14 Tu 10/13 I-Lab	In-Class Peer Review: Customer Needs Research This will be the first of three peer reviews you will have on your product development project. During class we will pair you up with other teams to present and give feedback to one another. Come prepared to share: 1) your mission statement, as is shown in your textbook, 2) a brief review of the means used to collect customer and user needs information, 3) a summary of the identified customer and user needs, 4) one of your most interesting use scenarios, and 5) a summary of lessons learned in the process to date. This is an opportunity to receive feedback from and give feedback to your classmates. It is also an opportunity to learn about new product development processes by observing what others have done on and learned from their projects.
T-4 Team Deliverable Due	Updated Business Proposition Canvas, Customer/User Needs Analysis with Progress (to date), Interview Debrief Sheets and Lessons Learned & Team Observations Your project should now have completed a first pass at the following activities: Gathered raw data on customer needs (through whatever means you deem most appropriate to your potential market); Generated a list of customer needs for your product and organized it hierarchically into primary, secondary and tertiary needs as described in your book; Identified three or four needs that you feel are important, but latent and not addressed by current products. Your Value Proposition Canvas and Assessment Plan should continue to evolve throughout the product development process as you learn more about your target market and gather feedback from faculty and others. You should continue to update these documents as you gather new inputs (archiving the old ones on the Web site).
15Th 10/15 Cal Design Lab	Concept Generation: Creativity & Brainstorming This class session will focus on brainstorming and "ideation" techniques used by new product development teams to generate product ideas from their understanding of customer wants and needs and of the available technologies.

We'll briefly review some of the commonly used techniques, and will then engage you in processing the concepts you've already generated, and in creating more within your teams.

Reading Read CHAPTER 7: "Concept Generation"

Read "Creative Thinking Techniques" (<http://www.virtualsalt.com/crebook2.htm>)

Scan: Ideation Methods theDesignExchange: <https://www.thedesignexchange.org/>

I-7 Generate 10 Concepts

Individual Assignment Due 10/15 Research has shown that more concepts are generated if team members first generate their own concepts prior to meeting in a team brainstorming session. Using the half-sheet form posted with the bCourses assignment, submit 10 individual concepts, post to your project folder (but don't look at the others yet) and bring to class in preparation for the team exercise.

16 Tu 10/20 Concept Generation: Structured Method

I-Lab This class will focus on structured methods for concept generation, such as Morphological Matrices, Functional Decomposition, Biomimetic Design, etc.

Reading Read "Morphological Charts",

<http://www.ifm.eng.cam.ac.uk/dmg/tools/concept/morph.html>

Scan "Creax Function Database", <http://function.creax.com/>

Scan "Biomimicry Institute", <http://www.biomimicryinstitute.org/> This class will focus on structured methods for concept generation, such as Morphological Matrices, Functional Decomposition, Biomimetic Design, etc.

T-5 Expansion of Concept Generation

Team Check-In After reviewing your teams' original 10 individual concepts, double the number through brainstorming and structured methods (e.g., for a team of 5, you should strive for a total of 100 concepts). After class in your next team meeting, expand your concepts using both brainstorming and structured methods and update your spreadsheet with the new concepts generated. Upload to bCourses before the next class.

17 Th 10/22 Concept Selection

Cal Design Lab Once you have generated a set of possible product concepts, you must identify the one or ones that you will actually work on. During this class session, we review methodologies for choosing from among the options, again drawing contrasts with start-up methods. During class, you'll work in your teams to apply the methods of this chapter to your projects.

Reading Read CHAPTER 8: "Concept Selection"

I-8 Concept Selection Criteria

Individual Assignment Due CHAPTER 8 describes concept screening and concept scoring matrices as a means of selecting among competing ideas for products you might develop. In concept selection, you will need to be clear about the criteria you are using to evaluate your concepts. Create a list of the top 7-10 selection criteria that you believe should be applied in the selection of the concepts you will further develop in class. Write each criterion on a Post-it note and bring it to class use in our concept selection exercises.

T-6 Team Concept Selection

- Team Check-In* In class, we will work on an exercise to select your top 10 product concepts from all the ones generated in the prior classes. Submit your 10 selections to your project bCourses folder by the end of the day or after your next team meeting (just make sure it is submitted before class on 10/27). Submit a team “lessons learned” document.
- 18 Tu 10/27 Prototyping: Lo-Fidelity**
- I-Lab* We will introduce tools and techniques for prototyping and testing your product concepts. Bring to class discarded items that would normally go to landfill to use as prototyping materials. Anything goes!
- Reading* **Read: “Prototyping Is The Shorthand Of Design”,**
http://www.ideo.com/images/uploads/news/pdfs/Kelley-Prototyping_Shorthand_DesignSummer-01.pdf
http://www.ideo.com/images/uploads/news/pdfs/Kelley-Prototyping_Shorthand_DesignSummer-01.pdf
Read: Sandhu, Jaspal S. “Measure early, measure often: rapid, real-time feedback in design for social innovation”. Jan. 2013:
http://poptech.org/e3_jaspal_sandhu
http://poptech.org/e3_jaspal_sandhu
- T-7 Team Check-In* **Prototype Photographs**
 Submit photographs/digital screenshots of any prototypes you create in-class by end of day.
- 19 Th 10/29 Prototyping: Concept Testing**
- Cal Design Lab* Concept testing should be done throughout the new product development process. This class will introduce various techniques that can be used at different stages.
- Reading* Read CHAPTER. 9: “Concept Testing”
 Read “Extremely Rapid Usability Testing”,
<http://grouplab.cpsc.ucalgary.ca/grouplab/uploads/Publications/Publications/2009-ERUT.JUS.pdf>) to get ideas as to how you can best use the time you will have with your fellow students in the In-Class Midterm Tradeshow on 11/3.
- T-8 Team Deliverable Due* **Project Deliverables (due Monday 11/2 by 5 p.m.)**
1. Prepare a THREE-SLIDE summary of your:
 - a. Mission statement
 - b. Target market
 - c. Salient customer needs
- Plan to orally present this one page summary briefly at the beginning of the class on Tuesday 11/3 in 3 slides in 1 minute: 20 seconds per slide. Submit the slides to the class GSI no later than 5p.m. on Monday, November 2. We’ll follow the same presentation format that we used in the proposal presentations. This will bring the entire class up to speed on your project before they review your work.
- 20 Tu 11/3 Midterm Trade Show Peer Review: 3 Concepts & Prototypes**
- I-Lab* **Session objectives:**
- o Update your classmates as to progress on your product development effort.
 - o Make the first “public” presentation of your “proof-of-concept ideas”.

- o Gather feedback from classmates on your concept design and mockups using concept-testing techniques.

From this point forward, your focus will be on developing and testing your product concept with your customer base, obtaining feedback, incorporating it into your product, and preparing intermediate and final product prototypes.

- T-9 Midterm Trade Show Deliverables**
- Team Deliverable Due*
1. The three slides you submitted on 11/2.
 2. Prepare your "proof-of-concept" sketches, product renderings and early prototypes so that everyone can understand your ideas. After the brief review at the beginning of the class, we will spend about 50 minutes in a "tradeshow" environment during which you will wander around the classroom to look at the other work. You are welcome to bring portable computers to set up your images. You should plan to handle any arrangements for using computers on your own.
 3. To support your concepts, you should have the following materials available. (Each team will likely have done different versions of these. Use what you have already developed.)
 - a. Customer/user needs hierarchy
 - b. Mapping of customer needs to specifications
 - c. Concept sketches
 - d. Product renderings or mockups (3D renderings, early physical or web mockups or screenshots)
 - e. Concept screening and scoring matrices
 - f. Reason for choosing the concept(s) you have developed for today

As we will only have about 50 minutes for this session, you should plan to have group members rotate responsibility for showing the concepts so that other group members can circulate. Think about the best way to efficiently and effectively collect feedback from your classmates. You may wish to have a mini-survey available for them to complete. Remember that each student reviewer will only have about 5 minutes to spend reviewing your work; so make your presentation as succinct as possible.

Be sure to upload all of these documents to your project bCourses, along with "lessons learned". Use the "DEL-Midterm" Folder.

- I-9 360 Peer Review and Team Process Survey**
- Individual Assignment Due*
- Complete the on-line peer review and team process survey. This will be emailed to directly to you today and **MUST** be completed by (11/5) 11:59pm for us to be able to provide feedback to your entire team next week.

21 Th Medium and High Fidelity Prototyping

11/5

Cal Design Lab Reading

Review of medium and high fidelity prototyping methods. Alpha and Beta testing of software; forward and backward software compatibility. *In-class exercise:* Prototyping lab. Review Ch. 14: Prototyping

22 Tu Team Process Check-In

11/10

I-Lab

This class session will be dedicated to giving your team an opportunity to reflect on your team dynamics. You will have the opportunity to leverage the findings from the team

process survey in your Collaborative Mapping session -- a technique designed to facilitate a team discussion in which you work together to identify your team's strengths as well as opportunities for adaptation. The primary goal of today's class is to give you an opportunity to reflect on your team processes, strategies and objectives to enhance your team's overall effectiveness in leveraging the diverse multi-disciplinary knowledge that resides in your team. Brandi Pearce, PhD from Teams@Haas will again join us.

**23 Th
11/12** **Product Architectures and More Business Models**

Cal Design Lab In this class, we extend our earlier business model discussions to product architectures and product platforms. In so doing, we will touch on all of the elements of the business model canvas developed for lean start-up methodology. Then, in an in-class exercise, you will develop your own rough business model using the business model canvas.

Reading Read CHAPTER 10: "Product Architecture"
Read "Business Model Canvas," <http://www.businessmodelhub.com/page/business-model-canvas>

**24 Tu
11/17** **Design for X: Design for Production and the Environment**

I-Lab Our "Design for X" sequence will cover design for the environment (DfE) and/or manufacture (DfM) as an example of design for production (DfP -- similar concepts have been applied to software and services). In this class session we'll cover more detailed issues of life cycle analysis and detailed design guidelines. Product costing will be covered in the next class.

Consider the following thought questions:

- How might you make tradeoffs among cost, quality, features and environmental soundness when designing a product?
- What are the steps in a "Cradle to Grave" life cycle assessment?
- What is the difference between the "cradle to grave" perspective and the "cradle to cradle" alternative?
- How might product architecture affect your DfE strategy?
- Are there any conflicts between DfM and DfE design guidelines?
- How might your DfM strategy vary with the production size of your product?

Reading Read CHAPTER 12: "Design For Environment" (new chapter in fifth edition)
Read CHAPTER 13: "Design For Manufacturing"
Read: from bCourses: Kambrook Kettle case study: "Mainstream appliance meets eco-design" (*Journal of Sustainable Product Design*)
Read: Lifecycle Assessment Primer by Jer Faludi and Adam Mentor,
http://faludidesign.com/MCAD_images/LCA_Primer_Autodesk-SWorkshop_Final.pdf

**25 Th
11/19** **Product Economics and Product Portfolio Management**

Cal Design Lab We'll share a spreadsheet that has been set up for you to use to develop the financials for the business case for your projects, and then lead you through an in-class exercise. We will place the business case for a single project within a larger product portfolio strategy.

Reading Read CHAPTER 17: "Product Development Economics"

T-10 Business Model Canvas

<i>Team Check-In</i>	Submit your team's business model canvas to your project bCourses. Include an updated mission statement (full one pager) and "lessons learned" as well. Complete your 360 Peer Review and Team Process Survey by today.
26 Tu 11/24	Successful Product Development Case Study: SideCar <i>Guest Lecture: Sunil Paul, CEO, SideCar (tbc)</i>
<i>I-Lab</i>	We will have an in-class discussion of SideCar, a startup playing at the leading edge of the emerging digital, data-driven share economy. We will be joined by SideCar's CEO, Sunil Paul, a serial entrepreneur with several startups under his belt, who will share both his product development experience with SideCar and his observations about how entrepreneurship is changing in the current.
<i>Reading</i>	Read TBD
Th 11/26	Thanksgiving. No class
27 T 12/1	Communication, Feedback on Presentations
<i>I-Lab</i>	As you approach the end of the semester, you should start thinking about how you will communicate your project outcomes to the judges who will be present at the final tradeshow. In this session we'll review good presentation and storytelling techniques, and let you start practicing applying them to your projects. We will use the last two class sessions to let you work on preparing your materials for the final tradeshow event. The faculty, your fellow students, and possibly some guest speakers will be available to go through your materials with you and help you formulate them for the final tradeshow.
<i>Reading</i>	Read: CHAPTER 1, "What Sticks?" In Made To Stick", http://www.madetostick.com/excerpts/
28 Th 12/3	Course Overview: Lessons Learned and Final Deliverables
<i>Cal Design Lab</i>	We will spend this class session sharing lessons learned and synthesizing those lessons across the projects.
<i>I-10 Individual Assignment Due</i>	Reflect on the experience you have had working with your team in developing your product this semester. Capture 8 ~10 key lessons you have learned from the experience. Write them up and submit them to the "assignments" tab under "lessons learned. In addition, transcribe each of them onto a post-it note (one per post-it). Bring those notes to class with you to share.
29 Tu 12/8 (I-Lab)	Review: Feedback on Presentations/ Final Deliverables
<i>I-Lab</i>	The teaching staff and guests will provide final review and feedback prior to the trade show on Saturday.
30 Sa 12/12	FINAL TRADESHOW Saturday, December 12, 1-4 p.m. (set-up time earlier) Wells Fargo Room, Haas School of Business

During the tradeshow, you will have the opportunity to display your product prototype to your peers, course faculty, the design coaches and a group of invited judges and guests. (Space reserved from 11:00 am ~5 pm.)

Attendance at the final tradeshow is MANDATORY as it is considered the “final” for the class.

Prepare a 10-minute presentation that describes your final product that will convince the judges that there is a viable market for your product, and that your proposed solution will be successful in that market. Remember that most of the judges will not be familiar with your project at all, never having seen any of your previous work, so you have to tell them a story about why there’s a need, how you focused on the customer to discover the detailed needs, and how you benchmarked and explored a wide range of potential solutions to come up with the best product.

The presentation should be of the quality to convince a top management group to purchase the rights to your product or a venture firm to fund its development and launch. An effective presentation includes a slide presentation along with a display of a working prototype. Be sure to include all areas covered in the judging form (to be posted on bCourses). Typical questions a judge might want answered.

- o How did you come up with this idea?
- o Who are the competitors and what products are out there now?
- o What need or needs are lacking in the current products out there?
- o Is there a large enough market for your product to make it successful?
- o Define what success is – financial, societal, environmental, etc.
- o What are your costs and can you make a reasonable profit, or if a non-profit, is it viable financially?
- o What ideas did you discard, and will your final product idea meet the customer needs?
- o What made you decide on that idea?

I-11 Complete the Team Evaluation Survey

Individual Assignment Use the same procedure as with the mid-term team evaluation survey.

I-12 Design journal

Individual Assignment Submit at the trade show. They will be returned the following week or at the beginning of the Spring semester upon request.

T-11 FINAL TEAM DELIVERABLES

Team Deliverable Due Submit in SINGLE FOLDER titled Final Deliverable in your project bCourses. Your final deliverables include:

1. Final mission statement
2. Final customer user needs assessment including whatever frames, personas, scenarios etc. you used, as well as a summary of who you interviewed, interview guides, example notes from interviews, focus groups, surveys, etc. You’ve done a lot of work in this area, so give us a concise yet convincing glimpse into your efforts.
3. Concept generation sketches, showing the breadth of concepts you generated throughout the semester

4. Concept selection matrices, particularly that highlight how you got to your final concept
5. Concept testing results and how those results affected your final design choices
6. Financial analysis, business model and triple bottom line considerations
7. A photo of your final prototype. We may ask to keep some of your prototypes, but cannot keep them all, so please submit a photo of the final solution
8. Copy of your presentation slides.