

University of California, Berkeley
Department of Mechanical Engineering

ME290KA: Innovation through Design Thinking (2 units)

Faculty:

Alan Van Pelt, Design Strategy consultant, (650) 248-3937, apvanpelt@yahoo.com

Teaching Assistant:

Chris Collins, Mechanical Engineering Graduate Student, cc33@berkeley.edu

Class Meetings:

M 1:00-4:00 pm; F 1:00-2:00 pm: Cal Design Lab (494 Wurster Hall)

Note:

- There will be no class or section on Fri, Aug 26.
- The first lecture will be on Monday, August 29, 1-4pm.
- No class on 9/5 due to holiday
- Class on Fri 9/2 will be 2 hours (1-3pm) to compensate for 9/5 holiday. All other Friday classes are 1 hour (1-2pm).

Office Hours:

Alan Van Pelt: After class and by appointment.

Chris Collins: To be announced

Duration of course:

August 29-October 15. The final will be held on either Friday October 14 or Saturday October 15, depending on the preference of the class. Please hold both dates open until this has been finalized.

Course Description:

Designed for professionally-oriented graduate students, this course introduces students to Design Thinking, a human-centered approach to innovation and problem solving. Design thinking combines empathy for people and the context of a problem, creativity in the generation of insights and solutions, and rationality in analyzing and fitting various solutions to the problem context. Design firms such as IDEO and Jump Associates describe it as "matching people's needs with what is technologically feasible and viable as a business strategy." The premise of teaching Design Thinking is that by knowing about how designers approach problems and the methods which they use to ideate, select and execute solutions, individuals and businesses will be better able to improve their own problem solving processes and take innovation to a higher level. Watch this 4 min video for a nice explanation of Design Thinking: <http://vimeo.com/90355541>.

This course emphasizes problem solving as a process within a people-centered context, employing methods from design, qualitative research, and prototyping, all in a collaborative, cross-functional environment. We will focus on collecting qualitative data, translating that data into unique insights and needs, and finally into products, services, and experiences that improve people's lives.

Course Objectives:

Design has become an increasingly powerful force in the last decade. What began as a focus on styling and aesthetics has led to sophisticated methods and processes for creatively tackling a wide variety of problems. More than ever, designers are called upon to place human needs at the center of their design engagement. As a result, Design Thinking has become a powerful approach to addressing issues at micro and macro levels, ranging from problem-solving complex social and cultural problems, to innovating in startups and Fortune 500 companies alike.

This course aims to teach students to be design thinkers who apply this problem solving and innovation process to a wide variety of problems. We will introduce students to the tools, practices, tenets, mindsets, and theory of Design Thinking, with an emphasis on practical application.

By the end of the semester, students will be able to:

- Explain the methods, processes, and key tenets of design thinking.
- Understand how a Design Thinking approach differs from other problem-solving approaches.
- Investigate problems, develop qualitative research methods, and synthesize results as a platform to create solutions.
- Develop a deeper and more holistic understanding of users and their needs, motivations, and behaviors.
- Develop unique insights about users, and focus those into design that has a clear perspective.
- Understand that, in addition to the creation of innovative objects and places, design thinking can be applied to the development of new processes, services, interactions, and collaborations.
- Recognize the interdisciplinary practice of various design professions and the value of design thinking as a means of innovative problem solving across disciplines.
- Build a rigorous and elegant argument for design projects.

Course Prerequisites:

Graduate level standing. This is not a technical course, and as such, no engineering knowledge is required.

Topics Covered:

Design thinking models and tenets, qualitative research methods, problem finding and framing, analysis and synthesis of research, abductive thinking, ideation and creativity techniques, experimentation and rapid prototyping, concept testing, iterative design, and identifying and communicating unique points of view.

Class/Laboratory Schedule:

This class builds on Confucius's notion: "*I hear and I forget. I see and I remember. I do and I understand.*" There will be a lot of doing in the class sessions to develop facility with the Design Thinking tools that students can apply to their own research projects and beyond.

- 4 hours of class per week for first half of Fall semester
- The three-hour sessions on Mondays will include lecture, discussion of readings, and some hands-on activities.
- The one-hour Friday session will include workshops and expose students to designers from industry and provide some practical advice.

Contribution of the Course to Meeting Professional Component:

The course focuses on “soft” professional skills that are critical for successful innovation in industry today. Design thinking—which involves thinking things forward, thinking laterally, thinking systemically and thinking synthetically—transcends roles and disciplines. It is essential both for analyzing existing conditions and generating new opportunities. By exploring different ways of thinking and learning, and equipping practitioners with processes and toolsets, we will see that the education of a design thinker can be preparation for many possible futures.

Assessment of Student Progress Toward Course Objectives:

30% on homework assignments

20% on participation and deliverables in final innovation challenge

20% on attendance and participation in class

15% on post-reflection

10% on teammate evaluation

5% on weekly reading assessment

Class Attendance and Participation:

There are only seven weeks of class for this course. All of these sessions will entail active discussion and exercises with others in the class. Your participation grade will be based on your *on-time arrival to and active participation in class sessions*.

Understandably, there may be a time we're you're absolutely unable to attend class, so we allow each student 1 free absence without penalty. Feel free to use it as you wish, no need to request permission.

Online Tools:

We will make extensive use of the course bcourse web site to both communicate information to you and to converse with you about your homework and your class challenges. You will find the bcourse site at:
<https://bcourses.berkeley.edu/courses/1453280>

Laptop, Tablet And Smartphone Policy:

Class time will focus almost entirely on in-class exercises to bring to life problem-based learning. You will need to give your full attention to your teammates, to the work you are being asked to do together, and to what you are taking away from that work. Please do not use your laptops or smart phones in class, unless it is for a class exercise or to take notes (no email, texting, web browsing, Facebook, etc.) Any violation of this policy will lead to a reduction in your participation grade. We love the way Adaptive Path, one of the design firms we work with, describes its policy along these lines:

***Honor the gathering.** In this ever more interrupt-driven digital world, it's a challenge to bring together all the right people at the same time to think, make and solve problems that are too complex for just a few people to figure out. Gatherings of this magnitude need opening ceremonies to acknowledge the value of the time we are about to spend together. Typically these ceremonies don't include marching bands or fireworks (although that would be cool), but there are small and simple actions that help us all recognize that this is a sacred time. These small things include sending out invitations ahead of time, providing food and drink, creating an environment where people can focus without laptops or smart phones, welcoming and orienting people to our day together, and having the client sponsor begin the workshop with essentially an opening blessing for the people gathered and the work we will accomplish.*
[\(\[www.adaptivepath.com\]\(http://www.adaptivepath.com\)\)](http://www.adaptivepath.com)

Textbook (s) and/or Other Required Readings:

Interviewing Users: How to uncover compelling insights by Steve Portigal.
Hardcopy available on Amazon and elsewhere. Search around for the best price.
eBook available for \$22 here: <http://shop.oreilly.com/product/9781933820118.do>

Other assigned readings are linked in the syllabus below and are also on BCourse. All readings should be finished before class, as your grade is partially based on your participation in class discussions about readings.

Homework Assignments:

For each class session there will be individual and group assignment that students must complete before coming to class. These assignments allow students to experiment with some of the techniques being taught in the class and will be the basis for in-class exercises.

Homework will be assigned in class, and detailed on BCourse, and is due by 1pm of the following class. Late homeworks will be penalized one-third of a grade for every day it's late. Eg, An A- becomes a B+ for one late day.

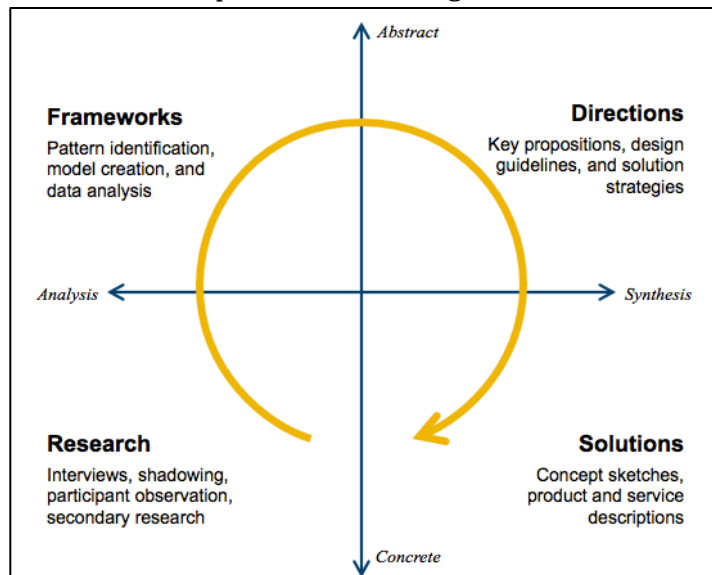
Course Design:

This is a project-based course. Students will form teams and work on a team project of their choosing (subject to instructor approval) for 6 of the 7 weeks. In the final week, all students will work on the same final design challenge, which will be announced in the 6th week of the class.

Week 1 (Mon 8-29): Introduction to Design Thinking

Design Thinking is an iterative process of Understanding, Ideation, and Realization. Using a human-centered approach, Understanding comes from empathy building and analysis techniques. Ideation is the process of generating and refining ideas based on that understanding. Realization is the process of making those ideas real enough that they can be interacted with to further understanding. You will be introduced to different models of Design Thinking, but we will use the one pictured here to organize class material.

In the first week, we'll introduce you to the Design Thinking process, talk about its relevance and importance, and engage in class exercises to try the entire process.



DESIGN THINKING MODEL

Readings (complete before 8-29 class, Take notes):

- Teamwork Tools handout. PDF on Bcourse.
- IDEO Shopping Cart Project. <http://www.youtube.com/watch?v=taJOV-YCiel>
- "Asking the important questions: A guide to design thinking." <http://www.innovationmanagement.se/2011/05/30/asking-the-important-questions-a-guide-to-design-thinking-and-a-better-way-to-serve-customers/>
- "Design Thinking," Tim Brown, Harvard Business Review, June 2008, <http://www.ideo.com/by-ideo/design-thinking-in-harvard-business-review>
- Process and Problem definition. <https://vimeo.com/57617635>
- What is Problem Framing in Design? <https://vimeo.com/6180364>

- Problem Framing, Jeremy Alexis.
<https://vimeo.com/groups/iitdesigncommunity/videos/21770257>

Week 2 (Friday 9-2, Friday 9-9): Building empathy through qualitative research

At the heart of Design Thinking is the ability to build empathy for users, to see situations from multiple perspectives, and to see with a “beginner’s eye.” Deep understanding of your users leads to new perspectives which, in turn, spawn novel solutions. This involves collecting both quantitative and qualitative data, and being open to questioning assumptions and trying on others’ points of view. For many reasons, people often have trouble directly articulating what they need and want. (Henry Ford: “If I had asked people what they wanted, they would have said faster horses.”) Your job is to watch people closely and elicit stories from them that give us clues about their unarticulated beliefs and needs.

This class session will focus on how to build deep empathy for users, including what to watch for, how to ask good questions and elicit stories from people, how to get to the heart of motivations, and why we need to question our initial assumptions and interpretations.

Readings (complete before 9-2 class. Take notes):

- Class slides: Research.pdf (on bcourse)
- “Spark Innovation Through Empathic Design.” Dorathy Leonard. Harvard Business Review.
http://iic.wiki.fgv.br/file/view/LEONARDO%3BSpark+Innovation...DesignHBRv75i6nov-dec_97.pdf
- Getting People to Talk: An Ethnography & Interviewing Primer,
<http://vimeo.com/1269848>
- Interviewing Users by Steve Portigal.
 - Skim Chapters 1 & 2
 - Chapters 5 & 6
- Alex Blumberg Interview: Part 2. The Tim Ferriss Podcast.
<http://fourhourworkweek.com/2015/01/29/alex-blumberg/>
Also here: <https://www.youtube.com/watch?v=d7KdASy-2jI>
- A palette of interview questions. PDF on bCourse.

Optional readings

- Going Deeper, Seeing Further: Enhancing ethnographic interpretations.
https://www.ideo.com/images/uploads/news/pdfs/jar_2006.pdf

Week 3 (Monday 9-12, Fri 9-16): Interpretation - Analysis of research

One of the most challenging parts of the Design Thinking process is making sense of the research data and developing insights. Dev Patnaik of Jump Associates calls it “cutting cubes out of fog.” This data can be hard data – statistics you’ve collected about your product, issue or situation, and it can be soft data – videotapes of the interviews you did with your customers, quotes from users and the like. Inevitably, when you start this part of the process, the pile of data looks overwhelming and it is hard to believe you will be able to learn anything meaningful from it. It may also appear to be nothing new, or overly subjective and anecdotal. We’ll focus on analysis techniques to help dissect stories you hear, find patterns, and draw out needs and unique insights that can be abstracted to a larger group. In this phase, you’ll seek to understand more deeply why people are doing and saying what they are, and describe that understanding with simple diagrams, models, and frameworks.

Readings (complete before 9-12 class. Take notes.):

- Class slides: Interpretation.pdf (on bcourse)
- Needfinding: The why and how of uncovering people’s needs. Dev Patnaik. <http://www.paulos.net/teaching/2011/BID/readings/needfinding.pdf>
- System Logics: Organizing your offerings to solve people’s big needs. Dev Patnaik. Design Management Review. http://users.tkk.fi/u/phannuka/articles/Patnaik_2004_System_Logics.pdf
- Jeremy Alexis 2/6: Analysis and Synthesis. Watch up to 13m45s. <https://vimeo.com/148034721>
- A Beginner’s Guide to Finding User Needs. Jan Dittrich. Read the ‘Analysis’ section only. <https://jdittrich.github.io/userNeedResearchBook/#toc53>
- Examples of cluster headlines from a project about books: <http://rosenfeldmedia.com/wp-content/uploads/2014/10/Portugal-Consulting-Reading-Ahead-Topline-Summary.pdf>

Optional readings

- “The Importance of Synthesis during the design process.” Jon Kolko. <http://www.jonkolko.com/writingInfoArchDesignStrategy.php>
- Digging beyond user preferences. Indi Young Google tech talk. Watch up to minute 47. Take notes. Hint: if you click on the gear icon, you can increase the playback speed. I like to watch at 1.25 or 1.5x. <https://www.youtube.com/watch?v=M4AsxNg9nNU>
- Observing the User Experience by . Ch 15: Analyzing Qualitative Data. Look on BCourse.

Week 4 (Monday 9-19): Directions - Finding a Unique and clear POV

While analysis techniques help clarify and organize your research, synthesis techniques help you come to a point of view. Your point of view is your unique design vision, derived from discoveries made in your

A Working Theory of Design Synthesis:

Design synthesis is an **abductive sensemaking process** of **manipulating, organizing, pruning** and **filtering** data in an effort to produce information and knowledge.

empathy building. It's a guiding statement that

http://www.jonkolko.com/projectFiles/preso/kolko_2010_07_sensemaking.pdf

focuses on specific users and insights. In this class, we'll focus on tools and methods that help to develop focus and a unique point of view. We'll learn to think about whitespaces and to create design principles.

Readings (complete before 9-19 class. Take notes.):

- Class slides: Directions.pdf (on bcourse)
- Abductive Thinking and Sensemaking: The Drivers of Design Synthesis. Jon Kolko. <http://www.jonkolko.com/writingAbductiveThinking.php>
- Point of View. <https://vimeo.com/50933741>
- Developing a Unique POV. Stanford Institute of Design. http://www.stanford.edu/class/me228/pdf/cia_pov_overview.pdf
- Case Study: How to use empathy to create products people love. Start at 25m20s through end. <https://vimeo.com/126976733#t=1520s>
- Summary of Zag by Marty Neumeier. <http://www.businessweek.com/stories/2006-11-16/the-onliness-of-strong-brandsbusinessweek-business-news-stock-market-and-financial-advice>
- Design Principles. <http://www.designkit.org/methods/27>
- Design Principles example: <http://www.designkit.org/stories/154>

Optional readings

- Experience Themes. <http://www.emdezine.com/making-experience-themes/>
- Excerpt from Needfinding by Dev Patnaik. Design Principles. On Bcourses
- Creating How Might We Statements. <https://vimeo.com/50934255>
- How Reframing a Problem Unlocks Innovation. Fast Company. <http://www.fastcodesign.com/1672354/how-reframing-a-problem-unlocks-innovation>

Week 5 (Monday 9-26): Solutions - Ideate, Prototype, Testing, Selection

The secret to good ideation is that the good ideas come from provocative prompts and questions. These prompts are often most successful when they come from specific and meaningful insights about your users and your challenge. When you mix

user insights with other kinds of prompts and force yourself to make connections, great ideas happen.

In the first three weeks, you will hear multiple times about the dynamic balance between diverging and converging. This session will focus on really diverging – or in other words generating a LARGE volume and WIDE range of ideas for your design challenge.

Prototyping is getting ideas and discussions out of your head and into the physical world. Prototypes force you to stop discussing and start creating. Your goal is to build to think and learn. Prototypes foster clarity and help engage your users in a different way, to further your understanding. A prototype need not be very polished, but should push you learning forward. A prototype could be as simple as a storyboard, or as complex as a 3D printed object. The idea is that the fidelity should be commensurate with your progress and what you want to learn about.

Getting feedback from others is an important part of the design process. Early on, your prototypes and ideas will be crude, so the type of feedback you solicit will be different than when your prototypes and ideas become more refined. We'll discuss different approaches to collecting feedback and how to address that feedback.

Readings (complete before 9-26 class. Take notes.):

- Class slides: Solutions.pdf (on bcourse)
- Read “Jump start your business.” Inc Magazine. May 2000.
<http://www.inc.com/magazine/19970501/1229.html>
- “How Pixar Fosters Collective Creativity.” Ed Catmull. Harvard Business Review.
<http://www.resourceful-humans.com/Documents/Catmull-CollectiveCreativity.pdf>
- How to have an Idea. <http://www.frankchimero.com/writing/how-to-have-an-idea/>
- Mash-ups. <http://www.ideo.com/pages/ideation-method-mash-up>
- Jeremy Alexis 3/6: Concept Generation. <https://vimeo.com/148034719>
- Prototyping. <https://vimeo.com/52442076>
- Jeremy Alexis 4/6: Prototyping. <https://vimeo.com/148034717>
- Skim “Concept Selection.” Ulrich & Eppinger.
http://www.mech.utah.edu/senior_design/07/uploads/Main/Lect12-ConceptSelection.pdf

Optional readings

- “Napkin Sketches 101.” Steelcase. PDF on Bcourse.
- What Google Learned from its Quest to Build the Perfect Team.
http://www.nytimes.com/2016/02/28/magazine/what-google-learned-from-its-quest-to-build-the-perfect-team.html?_r=2

- Where to Look for Insight.
<https://hbr.org/2014/11/where-to-look-for-insight/ar/1>
- Finding your innovation sweet spot. HBR March 2003.
<https://hbr.org/2003/03/finding-your-innovation-sweet-spot>

Week 6 (Monday 10-3): Storytelling and Effective Presentations

Throughout the class so far, stories have played an important role. We've talked about gathering stories from users or customers so that we can better understand their needs, and have shared the insights gained from observation and interviews in stories. We've used metaphors to generate ideas and frame compelling stories around those ideas, and created short stories to motivate adoption of new offerings. Broadly speaking, the Design Thinking process can be thought of one of "figuring out the story" and then "telling a new story". In this session, we focus on storytelling for its importance in engaging others in the ideas we generate through the design process. You'll learn about how to use story-telling techniques to inspire others to embrace your ideas.

Readings (complete before 10-3 class. Take notes.):

- This Advice will transform the way you give presentations:
<http://firstround.com/review/This-Advice-From-IDEOs-Nicole-Kahn-Will-Transform-the-Way-You-Give-Presentations/>
- The Irresistible Power of Storytelling. <https://hbr.org/2014/03/the-irresistible-power-of-storytelling-as-a-strategic-business-tool>
- How to Give a Killer Presentation. <https://hbr.org/2013/06/how-to-give-a-killer-presentation>
- "How to present like Steve Jobs." <http://blog.kissmetrics.com/present-like-steve-jobs/>
- "How to design and deliver presentations like a pro." Garr Reynolds.
http://www.garrreynolds.com/Presentation/pdf/presentation_tips.pdf
- Watch TEDx: Nancy Duarte: The secret structure of great talks, <http://youtu.be/1nYFpuc2Umk>

Optional

- Short blog posts by Nancy Duarte:
<http://blogs.hbr.org/video/2012/11/preview-hbr-guide-to-persuasiv.html>
<http://blogs.hbr.org/video/2012/12/create-slides-people-will-reme.html>
http://blogs.hbr.org/cs/2012/10/create_presentations_an_audien.html
http://blogs.hbr.org/cs/2012/10/do_your_slides_pass_the_glance_test.html
http://blogs.hbr.org/cs/2012/10/structure_your_presentation_li.html
http://blogs.hbr.org/cs/2012/11/disarm_your_audience_when_you.html
http://blogs.hbr.org/cs/2012/11/authentic_presentations_take_p.html
http://blogs.hbr.org/cs/2012/12/avoid_these_five_mistakes_in_y.html

http://blogs.hbr.org/cs/2013/03/when_presenting_your_data_get.html

Week 7 (Monday 10-10): Final Innovation Challenge & Summary

You'll present your project work to date to the class.

The remaining class time will be used to introduce the final innovation challenge, Review what we've learned, and discuss further topics for consideration.

The final exam will take the form of a final innovation challenge. You will have an opportunity to follow the entire Design Thinking process during this week. You will be given the final innovation challenge during an orientation session the prior week. We expect that you will compete in small teams. You will have time in class to plan your attack on the problem, how you will conduct your interviews, how you will share the insights you've gained, and anything else you want to do to prepare yourselves for the challenge. You'll have the opportunity to solicit feedback from instructors and TAs during the week.

Readings (complete before 10-10 class. Take notes.):

- "Becoming an Integrative Thinker." Roger Martin. Rotman Magazine Fall 2007. http://www.sterlinghall.com/uploaded/The_Institute/Becominganintegrativethinker.pdf
- Why Big Data Needs Thick Data. <https://medium.com/ethnography-matters/why-big-data-needs-thick-data-b4b3e75e3d7#.e05w9rceu>
- Agile, Lean, Design Thinking, Continuous Delivery... which should I use? <https://www.linkedin.com/pulse/agile-lean-design-thinking-continuous-delivery-which-should-jaye>
- Lean vs Design Thinking. <https://medium.com/art-marketing/lean-vs-design-thinking-6ae7c04453a6#.7l54p9un9>

Final Exam and Reflection: Final Innovation Challenge (10-14 or 10-15):

The final innovation challenge presentations will be either on 10-14 or 10-15, based on a class vote. An award will be given to the team with the best research and the team with the best solutions.

Post Reflection: An individual deliverable. We will ask you to write a short, 1-2 page reflection on what you learned from the class.