

## Course Description

# Design Thinking

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## The Big Picture

The objective of the course is to understand the theoretical foundations of the design thinking framework and apply its methods practically in projects.

Design thinking has been promoted conceptually by the Stanford School of Engineering [\[1\]](#) to systematically support innovative design processes. It is a user and customer focused process to develop solutions for complex and wicked problems [\[2\]](#).

Design thinking applies to all products, services, and all processes that can be shaped with intent [\[3\]](#). Everyone is a designer because we make conscious decisions to shape our environment (e.g. living rooms, work places, daily routines). In order to understand the philosophy behind design thinking, we need to get a clearer understanding of what design is. The course will explore several design theories and put an emphasis on design patterns.

## Intended Learning Outcomes

After this course, you will be able to:

- Apply the methods of design thinking to your projects
- Research requirements, problems and opportunities in problem domains

- Make design decisions based on trade-offs, clear criteria and critical reflection
- Use online tools for ideation and rapid prototyping
- Build new solutions based on design patterns

## Structure of the Course

### Values and principles of design thinking

Design thinking introduces normative principles such as lateral thinking, cross-disciplinary collaboration, experimentation and tinkering, storytelling, participation, co-creation and holistic problem analysis [\[2\]](#) putting human needs into the center of interest [\[4\]](#). We discuss each of the principles and see how to create environments that support design thinking. Design thinking can be supported by both online and offline tools.

### Process phases of design thinking

The systematic approach blends both analytical and synthetic phases. Deep understanding, observation and research, integrating multiple points of view, and testing are mainly analytical tasks. Ideation, tinkering and prototyping are rather synthetic phases. Design thinking integrates diverse methods for creative thinking and innovation into a unified process that iterates through each of the following steps:

- Understand: Deep understanding of the problem domain, requirements and needs, target audience and stakeholders.
- Observation: Observation of users and customers. Quantitative and qualitative research of functions and processes of the problem domain, ethnographic methods to better understand the actual situation, participative design methods and co-creation.
- Point of View: Aggregation of research results and interpretation from different perspectives.
- Ideation: Generating new ideas with creativity methods and lateral thinking
- Prototyping: Rapid prototyping in early stages of the design process to make solutions visible and easy to communicate.
- Test: Test and evaluate solutions with real users.

We will explore how each of the phases can be supported by web services. Moreover, we will use the methodology to design new services.

### Deep understanding and Research

Usage of scientific research methods to get a deep understanding. Systematic observation of what happens in the field of interest: how do people act, what are the processes, what are common pitfalls? Quantitative surveys and qualitative interviews, ethnographic methods to get a deep understanding

## Ideation

Creative thinking can be learned in the same way as analytical thinking [\[5\]](#). There are many collections of creativity methods, techniques and tools: Thinkertoys [\[6\]](#), How to get Ideas [\[7\]](#), or 101 Design Methods [\[8\]](#), to name just a few. The course will cover the most effective methods and students will apply them to their design challenge. Methods include the generation of new ideas by combining existing ones, changing perspectives, using random impulses as thought triggers, changing features in a systematic way, and using ideas from different contexts. These are just a few of the tools to generate ideas without relying on chance encounters. The ideation phase is about finding many ideas in short time periods.

## Prototyping and Testing

Prototypes are an important vehicle to test ideas early using simple models. Exploring concepts or models on a theoretical level only will not show all effects of their practical realization. It is hard to imagine how the objects feel and operate in the real world. Very often there are hidden side effects that can only be seen if the real artefact is tested. Design thinking suggests that creators should have a “conversation” with physical prototypes to test their real properties. We will discuss different types of prototypes, including proof-of-concept prototypes, visual prototypes, functional prototypes, paper prototypes and service prototypes. The course explains techniques of rapid prototyping and how to run fast iterations to improve design ideas continuously.

## Design patterns

Patterns have become a popular way to share good practices in a systematic way. The idea to capture patterns of good design has its origin in the field of architecture. Christopher Alexander et al. [\[9\]](#) wanted to create a language which helps ordinary people to participate and express their wishes and demands in the design of towns, buildings and constructions. The approach was adapted in many other fields, including software design [\[10\]](#), education and e-learning design [\[11\]](#) [\[12\]](#) [\[13\]](#) [\[14\]](#), and user interface design [\[15\]](#) [\[16\]](#).

According to Alexander et al. [\[9\]](#), „each pattern describes a problem which occurs over and over again in our environment, and then describes the core of the solution to that problem, in such a way that you can use this solution a million times over, without ever doing it the same way twice.“ As such patterns capture the essence of recurrent good solutions. They describe both the solution form and the process to generate this form. The reflective analysis of patterns requires that a description of patterns discusses how and why a solution works. A form or intervention is neither good nor bad in itself but produces different consequences depending on the context. Patterns are never seen in isolation but capture the environments in which they work, often by relating to other patterns.

## Didactic Concept, Schedule and Assignments

The course concept comprises basic readings, online workshops, online group work and an introductory and final on site presence. After a first introductory lecture on site, the subject is treated in three online workshops, that are supplemented by a session on site. Online workshops are held on three evenings with a duration of three hours each.

## **Introductory lecture on site**

The first on-site meeting will give a short introduction to design thinking, including some hands-on exercise. At the end of the session we will define a design challenge that will be used throughout the term. It is also the kick-off to enter the first two phases of the design thinking process: understand and observe. Online tools will be used to research, capture and share information about the problem domain. Teams can write collaboratively, upload ethnographic videos, run online surveys and aggregate their data.

## **1st Online Workshop**

This session will discuss design theory and methods.

After the presentation, a short lecture will provide an overview of design theories and design patterns. The session closes with a discussion about how these approaches can be applied to the design challenge and how the information that has been collected up to this point can be used now.

## **2nd Online Workshop**

The focus of this session is on the ideation phase. It will start with an overview of creativity methods for idea generation. We will discuss thought triggers, SCAMPER, use of random impulses, more effective variants of brainstorming, and visual thinking. We will use method cards and cluster ideas online. At the end of the session, each team should have generated at least 50 ideas for their problem domain.

## **3rd Online Workshop**

Prototyping and testing of ideas will be the main topic of this session. We will explore different ways of presenting prototypes to remote partners. Peers will test the proposed solutions of other course participants and provide constructive feedback. The testing will be based on screenshots, mockups, working prototypes or stories/performances. Moreover, we will use online collaboration tools to create prototypes and mock-ups within online sessions.

## **Wrap-up Session On Site**

Each team presents their design results and reflects about the design thinking methodology.

## **Examination**

Team work: Each team should deliver a 5-10 minutes presentation and a 10-page outline about how they applied the design thinking approach to their design challenge.

Individual work: Each individual should write 2 pages reflecting on how she can apply design thinking in their daily projects (work, learning, or private projects).

The grade will be based on:

- Group presentation at 2nd on-site weekend (33%)
- Group outline (34%)
- Individual work (33%)

The following questions may support your reflection process:

- Which methods did you use?
- Why did you choose the methods?
- Did the method work? Why? Why not?
- Which tools did you use?
- How many iterations did you run?
- What did you learn from the prototypes?
- How do problem space and solution space match?
- Which phase was most important?
- Which obstacle occurred?
- What would you do differently next time?

These questions are relevant for both individual and group reflection. To achieve a good or excellent grade, please mind the following criteria.

A good reflection ...

- Discusses your process in precise language
- Illustrates your outcomes and achievements
- States the lessons learnt (what worked, what failed, what to do differently)
- Explains how challenges have been addressed (e.g. workarounds, alternatives, unresolved problems)
- States benefits, drawbacks and liabilities of alternative ideas/solutions/prototypes that you developed
- Provides plausible reasoning and justifications (e.g. "We did A because of B")
- Offers evidence and examples for statements and claims
- Refers to the theoretical frameworks discussed in the course

## Suggested readings

- Alexander, C. (1979). *The Timeless Way of Building*. New York: Oxford University Press. [\[17\]](#)
- Cross, N. (2011). *Design thinking: understanding how designers think and work*. London: Bloomsbury Academic. [\[18\]](#)
- De Bono, E. (1990). *Lateral Thinking*. London: Penguin Books. [\[19\]](#)
- Doorley, S., & Witthoft, S. (2012). *Make space: How to set the stage for creative collaboration*. Hoboken, N.J: John Wiley & Sons. [\[20\]](#)
- Kelley, T., & Littman, J. (2001). *The art of innovation: Lessons in creativity from IDEO, America's leading design firm*. New York: Currency/Doubleday. [\[21\]](#)
- Michalko, M. (2006). *Thinkertoys: A handbook of creative-thinking techniques*. Berkeley, Calif: Ten Speed [\[6\]](#)
- Norman, D. A. (2002). *The design of everyday things*. New York: Basic books. [\[22\]](#)
- Von Oech, R. (2008). *A Whack on the Side of the Head*. New York: Grand Central Publishing Hachette Book Group. [\[23\]](#)

## Further readings

- Csikszentmihalyi, M. (1996). Creativity: Flow and the psychology of discovery and invention. New York: HarperCollinsPublishers. [\[24\]](#)
- De Bono, E. (1985). Six thinking hats. Boston: Little, Brown. [\[25\]](#)
- De Bono, E. (2007). How to have creative ideas: 62 exercises to develop the mind. London: Vermilion. [\[26\]](#)
- Foster, J. (2007). How to get ideas. San Francisco: Berrett-Koehler Publishers, Inc. [\[27\]](#)
- Goodman, N. (1968). Languages of art: An approach to a theory of symbols. Indianapolis: Bobbs-Merrill. [\[27\]](#)
- Iba, T. & Isaku, T. (2013). Collaboration Patterns - A Pattern Language for Creative Collaborations. 18th European Pattern Languages of Programs conference. Irsee, Bavaria [\[28\]](#)
- Kleon, A. (2012). Steal like an artist: 10 things nobody told you about being creative. New York: Workman Pub. Co. [\[29\]](#)
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- Lehrer, J. (2012). Imagine: How creativity works. Boston: Houghton Mifflin Harcourt. [\[30\]](#)
- Lupton, E. D. T., & Lupton, E. (2011). Graphic design thinking: Beyond brainstorming. New York: Princeton Architectural Press. [\[31\]](#)
- Michalko, M. (2011). Cracking creativity: The secrets of creative genius. Berkeley, Calif: Ten Speed Press. [\[32\]](#)
- Rising, L., & Manns, M. L. (2004). Fearless change: patterns for introducing new ideas. Upper Saddle River: Pearson Education. [\[33\]](#)
- Roam, D. (2008). The back of the napkin: Solving problems and selling ideas with pictures. New York: Portfolio. [\[34\]](#)
- Quillien, J. (2012). Clever Digs. How Workspaces Can Enable Thought. Ames, IA: Culicidae Press. [\[35\]](#)
- Sibbet, D. (2010). Visual meetings: How graphics, sticky notes, & idea mapping can transform group productivity. Hoboken, N.J: John Wiley & Sons. [\[36\]](#)
- Turner, M. (2014). The origin of ideas: Blending, creativity, and the human spark. Oxford: Oxford University Press. [\[37\]](#)
- Ware, C. (2010). Visual Thininkin for Design. Morgan Kaufmann [\[38\]](#)

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3. [↑](#) Cross, N. (2013). Design thinking: Understanding how designers think and work. London: Bloomsbury.
4. [↑](#) Gürtler, J., & Meyer, J. (2013). *30 minuten design thinking*. Offenbach am Main: GABAL Verlag GmbH.
5. [↑](#) De Bono, E. (1990, 2016). Lateral thinking: A textbook of creativity. London : Penguin Life.

6. ↑ [6.0](#) [6.1](#) Michalko, M. (2006). *Thinkertoys: A handbook of creative-thinking techniques*. Berkeley, Calif: Ten Speed.
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8. ↑ Kumar, V. (2013). *101 design methods: A structured approach for driving innovation in your organization*. Hoboken, N.J: Wiley.
9. ↑ [9.0](#) [9.1](#) Alexander, C., Ishikawa, S., Silverstein, M., Jacobson, M., Fiksdahl-King, I. & Angel, S. (1977). *A pattern language: towns, buildings, construction*. New York: Oxford University Press.
10. ↑ Gamma, E., Helm, R., Johnson, R. & Vlissides, J. (1994). *Design Patterns: Elements of Reusable Object-Oriented Software*. Reading, Mas. : Addison-Wesley.
11. ↑ Eckstein, J. (2001). "Learning to Teach and Learning to Learn - Pedagogical and Social Issues in Education". *EuroPLoP 2000. Proceedings of the 4th European Conference on Pattern Languages of Programs* (Konstanz: Universitätsverlag Konstanz): 75-86.
12. ↑ Bergin, B. (2001). "Fourteen Pedagogical Patterns". *EuroPLoP 2000. Proceedings of the 4th European Conference on Pattern Languages of Programs* (Konstanz: Universitätsverlag Konstanz): 1-40.
13. ↑ Köppe, C., Nijsten, M. (2012). "A Pattern Language for Teaching in a Foreign Language - Part 2". *19th Pattern Languages of Programs conference* (New York: ACM).
14. ↑ Kohls, C. (2009). "E-Learning Patterns - Nutzen und Hürden des Entwurfsmuster-Ansatzes". *E-Learning 2009. Lernen im digitalen Zeitalter* (Münster: Waxmann).
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28. ↑ [28.0](#) [28.1](#) Iba, T. & Isaku, T. (2013). "Collaboration Patterns - A Pattern Language for Creative Collaborations". *18th European Pattern Languages of Programs conference* (ACM: New York).
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27.02.2019