Tianjin University, School of Architecture, Design Thinking and Cognition
Spring 2023, S206E056, 1.5 Credits, 24 course hours.

Instructor:	Chiu-Shui Chan, Ph.D., Professor of Architecture/ISU, HCI/VRAC
Email address:	cschan@iastate.edu.
WWW course page:	https://cschan.arch.iastate.edu/235/TU_Cognition.html.
Meeting time & place:	Online class, 8:30am-10:45am Tianjin time, 2/27/2023 - 3/24/2023.

If you have any conditions such as a physical or mental disability which would make it difficult for you to carry out the work as outlined below, or which would require extra time on the final project; please notify me in the first week of the course so that I can make appropriate accommodations.

1. Short introduction

Design thinking relates to how we do design, how we think while designing. It has been studied in the 20th century on exploring systematic design, methodologies, essence of thinking, and designers' thinking processes. Then following the movement of information technology in the 21st century, design thinking has been moved to computational thinking as well. Only after the nature of cognitive operation in thinking is understood; then designers' thinking patterns could be differentiated and learned for improving design skills. Such assumptions set the purposes on covering the concepts of cognition, nature of thinking, movements of design thinking in the 20th & 21st centuries; studying master's design patterns and phenomenal thinking effects through series of lectures and in-class videos.

2. Course setting

The coronavirus (COVID-19) pandemic has tremendous impact to almost everything in our life globally, including this class. The teaching pedagogy and learning curve have been changed sequentially that have not been experienced before. The school will do all the best to make this class a successful one, and we should work together to make it happen – especially during this transitional stage that the pandemic is about over. If there are any technical difficulties happen during the class, we shall do all we could to resolve them. If there are any questions at any time, please use email, text, or ask in/after class for discussion. Again, this semester starts a new adventure and let's make it a great learning experience!

Most importantly, the class is offered online through freeware of Cisco's Webex Meetings. Thus, make sure that the system is installed with good internet connections. The class shall test the conferencing system on Saturday, 2/25 from 8:30-9:30am Tianjin time as a pilot study. Please be aware that there are 14 hours of time differences between China & US. The 8:30am-10:30am lecture time in Tianjin is one day ahead of 4:30pm-6:30pm Pacific Standard time and 6:30-8:30pm Central Standard time in US.

3. Background of course materials:

Design thinking have been studied in 1960 on methodologies. In 1970s, the intellectual phenomena occurring while designers do design was explored by various methods. These intellectual phenomena including the formation of intelligence, operation of knowledge, and actions to be taken for implementation are the cognitive activities examined in the field of psychology. During these years, the processes involved with psychological activities had been recognized as a special cognitive domain named "design cognition".

Design cognition focuses on the psychological processes of how humans understand, process, store, retrieve, and recycle design related knowledge that led to the creation of a design. These design processes are the unique forces that turn design conceptual schemes into physical artifacts. Among them, there are certain forces that create "recognizable features" in products, which would be recognized through perception to categorize them as an "individual style."

Behind these psychological phenomena, there also are some cognitive forces that trigger the creation of a unique design product that has the character of: "it is valuable, the act of creating it is original, and it is performed with special mental abilities which attribute creativity". Thus, creative products must be the works of initial and original creations. Outstanding creative works are generally treated as culturally influential, publicly recognizable, and socially beneficial products. Therefore, creativity and style are two cognitive factors affecting man-made products' quality and influencing civilization. If these cognitive aspects & factors were identified, then individual style and human creativity could be consciously improved accordingly to improve product qualities. At the end, computational thinking will be the highlight point for conclusion.

4. Objectives:

How do designers think? What makes a designer creative and successful? What shall be and could be done in the future IT era on design thinking?

These questions have been discussed in the field of design studies through studying cognitive phenomena occurred in the design processes. This course will introduce classical examples and current theories developed in this field. Particularly, cognitive factors driving the design process, problem solving activities on solving design problems, the factors on manifesting style, the sources of creativity, and the future on computational thinking in the IT driven 21st century shall be explained through cases to make the notion of design thinking clear.

5. Course Outlines by sessions (tentative schedule):

Lect#	Modules	Focus
0	System testing	Online Webex system
1	**Module 1:** Design thinking	Course introduction + Thinking
2		Historical development of design thinking / Literature
3		Cognition -- perception, attention, association & knowledge
4		Design cognition -- example of Gestalt psychology
5	**Module 2:** Problem solving	Concept of Problem-Solving Theory.
6		Design problem solving.
7		Methods of data collection, interview, observation, experts' study
8		Case study of experts' design problem solving -- protocol analysis
9	**Module 3:** Design methodology	Design methodologies -- analog, parti.
10		Work session on exercices.
11		Concept of representation and Metaphor.
12	**Module 4:** Style	Definition and concept of style.
13		Style in fine arts products -- Ven Gogh and Vemeer's painting.
14		Style in products -- case study on Frank Lloyd Wright.
15		Style in processes -- a psychological experiment.
16		Style identification.
17	**Module 5:** Creativity	Definition and concept of creativity in design.
18		Case study on Otto Wagner, Santiago Calatrava (analogy).
19		Case study on Renzo Piano (Group design case).
20		Creativity by design strategy.
21	**Module 6:** Design Strategies	Phenomenology in design strategy -- Case study on Steven Holl.
22		Rhythm in design thinking – Alva Aalto.
23		Design for future (Team design) in future (computational thinking)
24		Class summaries, midterm, and final presentations

6. Expected Outcome:

It is expected to learn enough information on design thinking and better understanding on: (1) the factors that generate style, (2) the origins of creativity, and (3) the new movement of computational thinking. It is also expected that the learned knowledge on computational thinking could be implemented in future design project to catch up the IT digital design trend in years to come.

7. Course calendar (tentative):

Su	M	Tu	W	Th	F	Sa
2/19/2023	2/20/2023	2/21/2023	2/22/2023	2/23/2023	2/24/2023	2/25/2023
						System test
2/26/2023	2/27/2023	2/28/2023	3/1/2023	3/2/2023	3/3/2023	3/4/2023
	Lect 1-2		Lect 3-4	Project selection	Lect 5-6	
3/5/2023	3/6/2023	3/7/2023	3/8/2023	3/9/2023	3/10/2023	3/11/2023
	Lect 7-8		Lect 9-10		Lect 11-12	
3/12/2023	3/13/2023	3/14/2023	3/15/2023	3/16/2023	3/17/2023	3/18/2023
	Lect 13-14		Lect 15-16		Lect 17-18	
3/19/2023	3/20/2023	3/21/2023	3/22/2023	3/23/2023	3/24/2023	3/25/2023
	Lect 19-20		Lect 21-22		Lect 23-24	
3/26/2023	3/27/2023	3/28/2023	3/29/2023	3/30/2023	3/31/2023	4/1/2023
	Midterm presentation					
4/2/2023	4/3/2023	3/20/2023	3/20/2023	3/20/2023	3/20/2023	3/20/2023
	Final Project Due					

Every lecture day has two sessions. The first one is from 8:30-9:20am followed by 9:30-10:20am (Tianjin time) sequentially. There will 10 minutes of break time between sections, and 10 minutes at the end for answering questions. Classes will be dismissed around 10:30am earlier or later.

8. Assignments:

There will be selection of research item (4 points), in-class exercises (18 points), a midterm (25 points) and a final project (45 points) with the following requirements. The remaining 8 points go to the class attendance.

- Stage A: Select an architect (or an architectural firm) to study. Choose four (or five) buildings designed by the architect (or firm), collect designers' drawings, outline the drawing data in PowerPoint to serve as the study plan (4 points), due 3/2/2023.
- Stage B: Apply the concepts introduced in lectures to "explore" the selected designs by the architect(s). For instance, analyze (1) his/her problem-solving methods used in the projects, (2) why his/her design products are stylistic, or (3) why his/her works are regarded as creative.
  A draft of the study should be outlined in logical sequence and presented on 3/27/2023 as a midterm project presentation (25 points).
- Stage C: A final paper of a 3-4 pages long essay with photos and bibliography shall be submitted by midnight of April 3rd, 2023 (45 points). Late submissions are not accepted.

9. Textbook

- **Design Cognition:** C. S. Chan (2008). *Design Cognition: Cognitive Science in Design*, Beijing: China Architecture & Building Press. (In both Chinese and English).

- **Style & creativity – English version option:** C. S. Chan, (2015). Style and Creativity in Design, *Studies in Applied Philosophy, Epistemology and Rational Ethics*, Volume 17, Springer: Switzerland. ISBN: 978-3-319-14016-2.
- **Style & creativity – Chinese version option:** 陈超萃（2016）《风格与创造力—设计认知理论》，天津大学出版社。
- Books and related papers were loaded on ResearchGate: https://www.researchgate.net/profile/Chiu-Shui-Chan/research for free download.

10. Suggested Reading

    a. Design thinking:
- i. Chan, C. S. (2022). Cognitive phenomena of style and creativity, *Journal of Design Planning and Aesthetics Research*, 1(2), 13-25.
- ii. Eastman, C. (2001). New directions in design cognition: Studies of representation and recall. In C. Eastman, M. McCracken & W. Newsteller (Eds.), *Design knowing and learning* (pp. 147-198), Amsterdam: Elsevier.
- iii. Lawson, B. (2006). How Designers Think: The design process demystified. Amsterdam: Elsevier, ISBN: 978-0-7506-6077-8.
- iv. Cross, N. (2011) Design Thinking: Understanding How Designers Think and Work. Oxford: Berg, ISBN: 978-1-84788-636-1 (paperback).

    b. Design methodology:
- i. Cross, N. (1984), Developments in Design Methodology, New York: John Wiley & Sons.

    c. Problem solving theory in all fields:
- i. Hayes, J. R. (1989). *The Complete Problem Solver*, Hillsdale, NJ: Lawrence Erlbaum Associates.
- ii. Chan, C. S. (1990). Cognitive processes in architectural design problem solving. Design Studies, 60-80.

    d. Style and creativity:
- i. Chan, C. S. (1992) Exploring individual style through Wright's design. Journal of Architectural and Planning Research, 14(1), 52-77.
- ii. Chan, C. S. (2000) Can style be measured? *Design Studies*, 21:3, 277-291.
- iii. Chan, C. S. (2001) An examination of the forces that generate a style. *Design Studies,* 22:4, 319-346.

    e. User centered design in all fields:
- i. Norman, D. (1988). *The Design of Everyday Things*, New York: Basic Books.
- ii. Petroski, H. (1990). *The Pencil: A history of design and circumstance*, New York: Knopf.

11. Critical stuff:

    a. *Class data:* Send the information of your English name (Fname_Lname), Chinese name, TJU student ID#, email address, and WeChat ID to cschan@iastate.edu for setting up class data.

    b. *Video conferencing:* Internet connection is critical. Please have a PC with Cisco's Webex Meetings software installed and functional. The lecture will be conducted through the Webex video conferencing. Webex meeting link is: https://iastate.webex.com/meet/cschan.
- As attendee in the meeting, mute yourself when you are not speaking and turn video camera on.
- Do not miss any lectures and turn off your cell phone in class.

    c. *File submissions*: Use VPN connecting to https://iastate.app.box.com/folder/132483862617, the Cybox in ISU server connections, which will be up after students' email addresses are confirmed.

    d. *Presentation:* For midterm presentation and final paper preparation, do not copy publications of other authors without citing the resources. It is because of that "**plagiarism**" is an unacceptable misconduct at this digital culture age and it would not be tolerated in this course.

12. Time zones

This class has students from different countries across difference time zones. Differences of time are converted to the list below for reference. Tianjin (or say Beijing) time is always used as the base for scheduling class activities.

Dubai (United Arab Emirates – Dubai)	Saturday, February 25, 2023 at	4:30:00 am GST	UTC+4 hours
Phnom Penh (Cambodia)	Saturday, February 25, 2023 at	7:30:00 am ICT	UTC+7 hours
Tianjin (China – Tianjin Municipality)	Saturday, February 25, 2023 at	8:30:00 am CST	UTC+8 hours
Minneapolis (USA – Minnesota)	Friday, February 24, 2023 at	6:30:00 pm CST	UTC-6 hours
San Francisco (USA – California)	Friday, February 24, 2023 at	4:30:00 pm PST	UTC-8 hours
Hamilton (Bermuda)	Friday, February 24, 2023 at	8:30:00 pm AST	UTC-4 hours

Notes:

1. *It is a courtesy to turn on your video while you are talking or making presentations. Especially the ten minutes period, before the class is dismissed is critical for face to face communication and discussions.*

2. *Email the instructor, after the syllabus is read, on regarding any questions you might have or say no questions.*