

University of Michigan School of Information
SI 435, Fall 2018
Exploring Computational Thinking Through Making
SYLLABUS

Instructor: Dr. Patricia Garcia

Meeting Time: Wednesday 1:00-4:00 pm
Location: AADL Secret Lab
Office Hours: Monday 11:00 am-1:00 pm

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Office: 4437 North Quad

Introduction

This is a three-credit course designed to provide students with a foundational knowledge of computational thinking, a set of problem-solving skills, through project-based learning that incorporates making activities. **The course will involve identifying an information/design issue, researching and collecting data on the issue, brainstorming solutions or interventions, designing early prototypes using making activities, testing, and communicating the results via an in-class presentation.** Additionally, the course will include visits to the Secret Lab, a nearby makerspace housed at the Ann Arbor District Library where students will have access to a variety of tools, including 3D printers, microcontrollers, and other materials for physical prototyping.

This course also provides opportunities to build your portfolio of professional skills, in particular: oral presentations (report outs from groups); writing and argumentation (final paper); problem analysis and problem solving (class discussion and group work); and teamwork/collaboration.

Organization

The course structure will include a combination of lectures, hands-on making activities, and small group presentations. The course is separated into two parts.

Part 1: Collaborative Issue Analysis

During the first part of the course, you will use computational thinking skills to conduct a **collaborative** analysis of health tracking technologies. During this phase, you will work closely with peers and will gain practice using computational thinking skills to identify information issues, decompose issues into manageable tasks, brainstorm solutions, and design prototypes using making skills.

Part 2: Individual Issue Analysis and Project Development

During the second part of the course, you will follow the same systematic process by utilizing computational thinking skills to address an information or design issue of your choice. During this phase, you will work more **independently**; however, you will still benefit from peer collaboration through small group work and peer critiques.

Course Goals and Objectives

Upon completion of this course, students should be able to:

- Apply computational thinking skills when analyzing a complex information issue
- Create prototypes using a variety of maker tools
- Engage in constructive peer critique and collaboration
- Communicate a complex information issue and proposed solution persuasively via written and oral presentations

Assignments and Important Dates

Part I: Collaborative Issue Analysis Using CT Skills			
Assignment		Due Date	Evaluation
Weekly Homework	1: Health Tracking Journal	9/19	20% (Complete /Incomplete)
	2: Identifying Issue	9/26	
	3: Decomposing Issue	10/3	
	4: Brainstorming Solution & Designing Prototype	10/10	

Part II: Individual Issue Analysis Using CT Skills			
Final Project	Identifying Issue	10/17	10 %
	Decomposing Issue	10/24	10%
	Brainstorming Solution & Designing Prototype	11/07	10%
	Communicating Solution via Final Presentation	11/28 & 12/05	10%
	Final Prototype (Artifact + Project Documentation via Online Exhibit)	12/12	20%
Participation			20%

Grading Scale

A+ 98-100%

A 94-97%

A- 90-93%

B+ 88-89%
 B 84-87%
 B- 80-83%
 C+ 77-79%
 C 73-77%
 C- 70-72%
 D 60-69%
 F below 60%

Expectations

I expect you to participate productively in classroom discussions, debates, and exercises. Your ability to contribute to classroom activities will depend on your advance preparation, including completing all reading; listening to/watching pre-recorded talks, lectures, presentations, videos, etc. You will also have the opportunity to initiate discussions and bring related material to our attention. The rubric below is an example of how I will assess your participation in the course.

	Satisfactory	Needs Development	Unsatisfactory
Listening	Actively and respectfully listens to peers and instructor.	Sometimes displays lack of interest in comments of others.	Projects lack of interest or disrespect for others.
Preparation	Arrives fully prepared with all assignments completed, and notes on reading, observations, and questions.	Sometimes arrives unprepared or with only superficial preparation.	Exhibits little evidence of having read or thought about assigned material.
Quality of Contributions	Comments are relevant and reflect understanding of assigned texts; previous remarks of other students; and insights about assigned material.	Comments sometimes irrelevant betray lack of preparation, or indicate lack of attention to previous remarks of other students.	Comments reflect little understanding of either the assignment or previous remarks in seminar.

Missed Class

If you are unable to attend class, please inform me in advance by email to garciapg@umich.edu and indicate the reason for your absence.

Materials

No textbook is required for this class. Course readings will be posted as PDFs and links on the course website in Canvas. Your projects may require additional materials and

supplies. These can be ordered from companies such as Adafruit, Sparkfun, or Maker Shed.

Late Assignments

1. Late assignments will receive a 5-point deduction per day past the due date.
2. Assignments submitted two weeks late or after the final date of the class will not be accepted.

Office Hours

Students are strongly encouraged to take advantage of office hours during the semester. **The instructor is available on Mondays from 11:00 am-1:00 pm at North Quad 4437.** Office hours should be scheduled using the online Google calendar: <http://goo.gl/Q31PUc>

These meetings can be used to discuss assignments, readings, and grading. If you are confused or struggling to complete an assignment, **DO NOT** wait until the night before the assignment is due to contact the instructor. Being proactive and requesting feedback early in the process will yield a better response.

Academic Integrity

Original Work. All submitted work must be your own, original work unless otherwise specified in the instructions for an assignment. Copying work of another student and asking someone to contribute to or complete your work on individual assignments is a form of academic misconduct (cheating). The use of ideas or expressions from others without attribution is another form of academic misconduct (plagiarism). Any violation of the School's policy on Academic and Professional Integrity (found in the student handbooks) will result in serious penalties. These range from failing an assignment, to failing a course, to being expelled from the program. Violations of academic and professional integrity will be reported to the UMSI academic integrity officer (usually the Assistant Dean). You are entitled to challenge allegations of academic misconduct and/or explain your actions. The faculty instructor determines consequences impacting assignment or course grades; the Associate Dean for Academic Programs may impose additional sanctions.

Collaboration. Collaboration is an effective learning tool and you are encouraged to review and discuss course readings and materials with other students as a general practice. However, individual assignments must be your own work. Read the instructions for each assignment carefully and request clarification about collaboration when in doubt. Conversely, group work is a central part of this course. As part of a group you will be subject to group norms with a common understanding that everyone is expected to participate fully.

Plagiarism. You may incorporate selected excerpts, statements or phrases from publications by other authors, but they must be clearly marked as quotations and must be attributed. If you build on the ideas of prior authors, you must cite their work. You may obtain copy editing assistance, and you may discuss your ideas with others, but all substantive writing and ideas must be your own, or be explicitly attributed to another. See the (Doctoral, MSI, MHI, or BSI) student handbooks available on the UMSI intranet for the definition of plagiarism, resources to help you avoid it, and the consequences for intentional or unintentional plagiarism.

Students with Disabilities

The University of Michigan is committed to providing equal opportunity for participation in all programs, services and activities. Request for accommodations by persons with disabilities may be made by contacting the Services for Students with Disabilities (SSD) Office (<http://ssd.umich.edu>) located at G664 Haven Hall. The SSD phone number is 734-763-3000. Once your eligibility for an accommodation has been determined you will be issued a verified individual services accommodation (VISA) form. Please present this form to me at the beginning of the term, or at least two weeks prior to the need for the accommodation.

Mental Health and Wellbeing

The University of Michigan is committed to advancing the mental health and wellbeing of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of support, services are available. For help, contact Counseling and Psychological Services (CAPS) at (734) 764-8312 and <https://caps.umich.edu/> during and after hours, on weekends and holidays, or through its counselors physically located in schools on both North and Central Campus. You may also consult University Health Service (UHS) at (734) 764-8320 and <https://www.uhs.umich.edu/mentalhealthsvcs>, or for alcohol or drug concerns, see www.uhs.umich.edu/aodresources. For a listing of other mental health resources available on and off campus, visit: <http://umich.edu/~mhealth/>.

Use of Technology in the Classroom

Students are allowed to bring a laptop, notebook, tablet computer, or hand-held device to class if they plan to use them actively as learning tools. Students should:

- *Use* laptops for taking notes, conducting research required for activities, and other specific classroom tasks as assigned by the instructor. During class, you should strongly resist the temptation to check e-mail, chat, IM, tweet, play games, or perform other off-task activities.
- *Engage* in class activity as actively as you can. The computer should not become a barrier to interaction and engagement, but instead should help facilitate the exchange of ideas and engagement in classroom contact. If you know you are not good at multi- tasking and your electronic devices become a distraction rather

than an aide, focus on the opportunity to listen – think – talk without mediation.

- *Show* sensitivity to others. You should not display screen images and multimedia content that might be distracting or offensive to other members of the class, including wallpapers, screen savers, or random browsed content.

Course Schedule

Part I: Collaborative Issue Analysis Using CT Skills		
Objectives	Assignments	Readings
Week 1 (9/5): What is Computational Thinking?		
<p>Students will be able to:</p> <ul style="list-style-type: none"> • Comprehend major assignments and course expectations • Understand space expectations for the AADL Secret Lab • Identify basic maker tools and materials 		
Week 2 (9/12): Problem Scenario: Health & Fitness Tracking		
<p>Students will be able to:</p> <ul style="list-style-type: none"> • Analyze the design of a fitness tracking technology (CT lab) • Practice basic sewing skills 	<p>Maker skills survey</p>	<p>Reminder: Class will meet at the Ann Arbor District Library's Secret Lab (343 South Fifth Avenue)</p> <p>Wing, J. M. (2006). Computational thinking. <i>Communications of the ACM</i>, 49(3), 33-35.</p> <p>Video: Wayne, L. (2015). What is computational thinking?</p>

<ul style="list-style-type: none"> Comprehend the application of basic sewing skills to prototyping 		<p>Williams, B. (2016, December 16). Your wearable-tracked health data is for sale, according to a new study. Retrieved from <i>Mashable</i>.</p> <p>Yeung, D. & Cevallos, A. (2017, May 11). Using wearable fitness devices to monitor more than just fitness. Retrieved from <i>Scientific American</i>.</p>
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Week 3 (9/19): Identifying Design or Information Issue

<p>Students will be able to:</p> <ul style="list-style-type: none"> Apply pattern recognition and abstraction to identify design or information issues based on your user experience of wearing a fitness tracker or using a health app. Comprehend how to use the concept of “defamiliarization” to create new designs Practice beginning circuitry skills to create paper circuits 	<p>Health tracking journal</p>	<p>Video: Abstraction</p> <p>Croisant, J. (2012). Thinking Abstractly: Why programmers don't write binary code. Retrieved from Atomic Object.</p> <p>Clawson, J., Pater, J. A., Miller, A. D., Mynatt, E. D., & Mamykina, L. (2015). No Longer Wearing: Investigating the Abandonment of Personal Health-tracking Technologies on Craigslist. In <i>Proceedings of the 2015 ACM International Joint Conference on Pervasive and Ubiquitous Computing</i> (pp. 647–658). New York, NY, USA: ACM. https://doi.org/10.1145/2750858.2807554</p> <p>Bell, G., Blythe, M., & Sengers, P. (2005). Making by Making Strange: Defamiliarization and the Design of Domestic Technologies. <i>ACM Trans. Comput.-Hum. Interact.</i>, 12(2), 149–173. https://doi.org/10.1145/1067860.1067862</p>
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Week 4 (9/26): Using Decomposition to Breakdown Design or Information Issue

	<p>Issue Identification</p>	<p>Video: Decomposition</p> <p>Resource: How to Solder</p>
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<p>Students will be able to:</p> <ul style="list-style-type: none"> • Apply decomposition to breakdown an information or design issue into manageable tasks in order to develop feasible and parallel solutions. • Practice beginner-level soldering skills 		<p>Purpura, S., Schwanda, V., Williams, K., Stubler, W., & Sengers, P. (2011). Fit4Life: The Design of a Persuasive Technology Promoting Healthy Behavior and Ideal Weight. In <i>Proceedings of the SIGCHI Conference on Human Factors in Computing Systems</i> (pp. 423–432). New York, NY, USA: ACM. https://doi.org/10.1145/1978942.1979003</p> <p>Lupton, D. (2013). Quantifying the body: monitoring and measuring health in the age of mHealth technologies. <i>Critical Public Health</i>, 23(4), 393-403.</p>
<p>Week 5 (10/3): Design Critiques</p>		
<p>Students will be able to:</p> <ul style="list-style-type: none"> • Demonstrate communication skills by presenting a solution and design sketch to the group • Practice participating in design critiques and learning to give thoughtful and productive feedback. • Practice physical prototyping with low-cost materials 	<p>Decomposing Issue</p>	<p>Wilshere, A. (2017). How to give and receive design critique well. Retrieved from Design Lab.</p> <p>Christensen, T. (2016). Four things working at Facebook has taught me about design critique. Retrieved from Medium.</p> <p>Sharon, T. (2017). Self-Tracking for Health and the Quantified Self: Re-Articulating Autonomy, Solidarity, and Authenticity in an Age of Personalized Healthcare. <i>Philosophy & Technology</i>, 30(1), 93–121. https://doi.org/10.1007/s13347-016-0215-5</p>

Week 6 (10/10): Using Abstraction to Design a Prototype

<p>Students will be able to:</p> <ul style="list-style-type: none"> • Apply abstraction to identify the main elements of the group's proposed solutions to create a new and improved design for a fitness tracker • Practice using a microcontroller and programming in the Arduino IDE 	<p>Brainstorming Solution & Designing Prototype</p> <p>Download the Arduino IDE for your operating system.</p>	<p>Maker 101: What's an Arduino?</p> <p>Make: Introduction to Arduino</p> <p>Maker 101: Arduino Programming</p> <p>How to Use a Bread Board via Sparkfun *If you want a more detailed account of using breadboards, read through the Science Buddies version</p> <p>Chachra, D. (2015, January 23). Why I Am Not a Maker. Retrieved September 5, 2018, from https://www.theatlantic.com/technology/archives/2015/01/why-i-am-not-a-maker/384767/</p>
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Week 7 (10/17): Using Algorithmic Thinking to Communicate Design Solutions

<p>Students will be able to:</p> <ul style="list-style-type: none"> • Apply algorithmic thinking to create a list of ordered steps capable of clearly communicating design processes • Practice creating alternative designs and solutions • Comprehend how to integrate touch and input features 	<p>Issue Identification</p>	<p>Makey Makey - An Invention Kit for Everyone</p> <p>Makey Makey - Quick Start</p> <p>Class Project Instructions</p> <p>Emerson, S., & Koebler, J. (2018, March 25). Shenzhen's Homegrown Cyborg. Retrieved September 5, 2018, from https://motherboard.vice.com/en_us/article/3kjqdb/naomi-wu-sexy-cyborg-profile-shenzhen-maker-scene</p>
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<p>using a Makey Makey</p>		<p>Kobie, N. (n.d.). How a DIY YouTuber became the target of a sexist conspiracy theory. Retrieved September 5, 2018, from https://theoutline.com/post/2459/how-a-diy-youtuber-became-the-target-of-a-sexist-conspiracy-theory</p> <p>My Apology to Naomi Wu and the Make Community I Make: (2017, November 19). Retrieved September 5, 2018, from https://makezine.com/2017/11/19/apology-to-naomi-wu/</p>
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Part II: Individual Issue Analysis Using CT Skills

Week 8 (10/24): Part II: Using Decomposition to Breakdown Issue

<p>Students will be able to:</p> <ul style="list-style-type: none"> • Apply decomposition to break down their chosen information or design issue into manageable tasks • Practice participating in peer-to-peer brainstorming • Employ research skills to gather data on their chosen information or design issue • Practice scholarly independence by appropriately using open lab time to further their project 	<p><u>Issue Decomposition</u></p>	<p>In preparation for class, review the following websites for ideas on projects and for better understanding how project documentation works:</p> <p><u>Instructables</u> <u>Makezine</u> <u>Thingiverse</u> <u>Hackaday</u> <u>Adafruit</u></p>
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Week 9 (10/31): Part II: Using Algorithmic Thinking to Create Project Schedule

<p>Students will be able to:</p> <ul style="list-style-type: none">• Apply algorithmic thinking to create a list of ordered steps for completing your chosen prototype on time• Create a project schedule for completing final project• Practice scholarly independence by appropriately using open lab time to further their project	<p>Review 435 sample digital project exhibit</p> <p>Download Word Templates for Creating a Project Schedule</p>	<p>No author. (2017). <u>What is Prototyping?</u> Interaction Design Foundation.</p> <p>Dam, R. & Siang, T. (2017). <u>Prototyping: Learn Eight Common Methods and Best Practices.</u> Interaction Design Foundation.</p> <p>Ray, S. (2017). <u>How to Create a Project Management Plan.</u> Project Manager.</p>
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Week 10 (11/07): Part II: Project Day & Individual Conference

<p>Students will be able to:</p> <ul style="list-style-type: none">• Evaluate the current status of their final project• Communicate project progress during one-to-one meeting with Dr. Garcia• Practice scholarly independence by appropriately using open lab time to further their project	<p>Brainstorming Solution & Designing Prototype</p> <p>You will be meeting with me to discuss your project. You should come prepared with any questions and the ability to succinctly communicate the goal of your project.</p>	<p>Review tips and techniques for presenting prototypes and concepts:</p> <p>Guidance When Presenting Prototypes</p> <p>The Art of Presenting a Concept</p>
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Week 11 (11/14): Part II: Using Abstraction to Design a Prototype

Students will be able to:

- Apply abstraction to identify the main elements of their proposed solution and prototype (What should be communicated in your final presentation and project documentation?)
- Practice scholarly independence by appropriately using open lab time to further their project and prep for final presentation

[Prototype Design](#)

Review how others have presented their designs:

[Projects at the MIT Media Lab](#)

[Projects at Stamps School of Art and Design](#)
[Quincy Bock Personal Portfolio](#)

Consider the following questions for documenting your design:

Explain the problem

- What is the problem or need?
- Who has the problem or need?
- Why is it important to solve?

Explain your proposed solution

- What is the proposed solution?
- Why did you choose this solution?

Explain your design process

- What iterations did your design process include?
- What making skills did you use?
- Include documentation - photographs, sketches

Explain how you used any of the CT skills

- i.e. How did you use decomposition to break down the problem into manageable tasks?

Week 12 (11/21): Part II: No class. Thanksgiving Break

Week 13 (11/28): Part II: Final Presentations

Communicating
Solution via
Final
Presentation

Week 14 (12/05): Part II: Final Presentations

Communicating
Solution via
Final
Presentation

**12/12: Final Prototype (Artifact + Project Documentation via Online Exhibit) Due
by 4:00 PM**