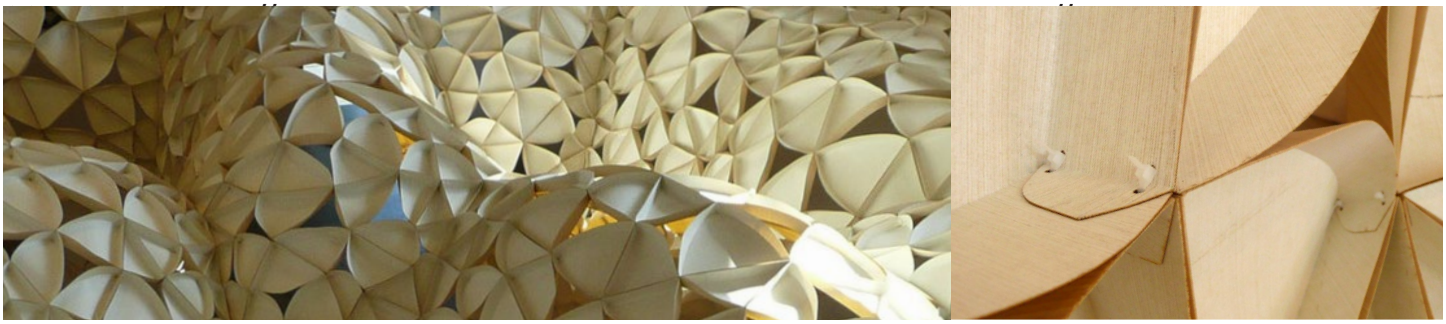


Iwamoto Scott - Voussoir Cloud

ARCH 212 : DIGITAL FABRICATION - *ADVANCED DIGITAL MODELS*

SCHEDULE:
Tuesdays: 9:30am - 12:30pm

INSTRUCTOR:
Cam Parkin - *jcparkin@uwaterloo.ca*

TEACHING ASSISTANTS:
James Clarke-Hicks - *jl2clarkehicks@uwaterloo.ca*
Meghan Tatiana Won - *mtwon@uwaterloo.ca*

TERRITORIAL ACKNOWLEDGMENT:
We acknowledge that the School of Architecture is located on the traditional territory of the Neutral, Anishinaabeg and Haudenosaunee peoples. The University is situated on the Haldimand Tract, the land promised to the Six Nations that includes 10 kilometres on each side of the Grand River. (see references here: https://uwaterloo.ca/engineering/about/territorial-acknowledgement)

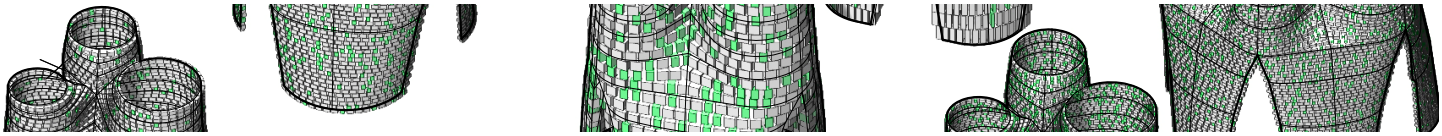
COURSE DESCRIPTION:
This course examines the role of computer-aided design (CAD) and computer-aided manufacturing (CAM) technologies in crafting robust design methodologies. At this point, you have a solid foundation in digital modeling and visual representation. Rather than pursuing expertise in one facet of advanced digital design, this course will serve as a springboard into multiple avenues of interest where digital tools can enhance design methodologies. In this class, we will look at three specific examples of how CAD and CAM technologies are capable of extending our ability to engage increasingly complex design scenarios.

In the first unit, we will explore the role of digital fabrication in design, as well as the translation between digital and physical as a fertile ground for design research. In the second unit, we will focus on the implementation of parameters, algorithms and associations in creating iterative and flexible models with embedded design logics. In the final portion of the class we will experiment with analytical tools in pursuit of intelligent digital models that are aligned with our design goals.

The course will begin by covering technical skills and their practical applications in design studios, and as it proceeds, the class will engage in more conceptual discussions about the role of digital tools and computation in the greater realm of design.

OBJECTIVES:

Concepts:
- Translations between digital and physical models as moments for design exploration
- Parameters, associations and procedures as design drivers
- Augmented intelligence through analytical feedback tools + integrated digital design methodologies



Retrospective Iterations by author based on - Hy-Fi by The Living

Technical Skills:
- Confidence modeling complex meshes and surfaces in Rhinoceros 3D
- Knowledge of digital fabrication techniques and processes
- Basic knowledge of parametric/algorithmic/associative design
- Comfortability with Grasshopper for Rhino
- Ability to pull quantitative data from a model that is associated with design goals

Soft skills:
- Digital collaboration
- Metacognition and autodidacticism
- Time management
- Digital file organization, hygiene, and habits
- Translation of concepts and techniques between different design problems

STRUCTURE:

Lectures/Assignment Intros (MS Teams, recorded, synchronous): Most class will begin with a lecture or introduction to discuss the concepts that will be covered and outline any labs/assignments. This will be an important touch point to make sure everyone is on the same page regarding approaches and expectations.

Tutorials (MS Teams, recorded, synchronous & asynchronous): During tutorials we will cover specific software and techniques. Tutorials will be either live and recorded, or will be prerecorded so that students can go through them at their own pace. General questions and clarifications can be addressed during this time, or in the support channel afterwards.

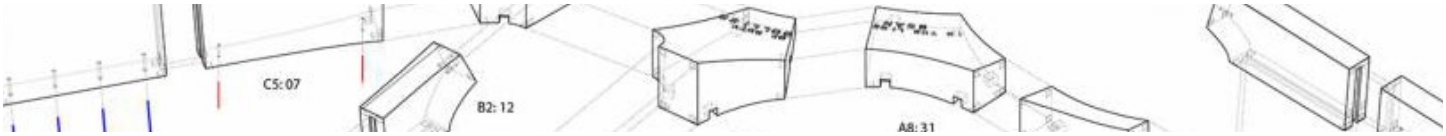
Worksessions (In person*, location TBA): Worksessions will act as a chance for students to share progress on their assignments and get feedback and troubleshooting advice from the teaching team. Time not spend in small working groups with the teaching team should be spent working on assignments.

Shop Time (In person*, Workshop & Mlab): To support the digital fabrication component of this course, there will be dedicated slots to book time on fabrication equipment. These slots will be concentrated on Tuesdays and will be supported by shop staff and the Arch 212 TAs. Students will sign up in advance for these slots and will be responsible for completing their tasks within them. Due to physical distancing requirements, these slots will be rigid. It will be paramount that students plan their time to prepared for their fabrication time. To maximize fabrication time, some fabrication slots will take place during class hours. In these cases, all content will be recorded so that it can be revisited.

Labs: Some tutorials will be accompanied by an assigned lab, where students will document and submit their activities. Labs will be marked for completion to be sure students are keeping up with the content and assignments. Each lab will be due at the beginning of the next week's class, but it is highly recommended that students complete the lab during class time or on Tuesday afternoon.

Assignments: Assignments are large projects that will be evaluated based on their quality and ability to incorporate course concepts.

*note: All in person activities will have remote options



Howeler Yoon - Collier Memorial

ASSIGNMENTS:

Labs - Completion of in-class activities - 5% x 6 = 30%
Due @ 9:30am week after assigned

Assignment 1: Fabrication - 35%
Pt I: Proposal (20%)
Due @ 10pm on October 8th
Pt II: Results (15%)
Due @ 10pm on December 18

Assignment 2 - Parameters/Procedures/Associations - 20%
Due @ 10pm on November 23

Assignment 3 - Analysis - 15%
Due @ 10pm on December 7

EVALUATION:

Completion grading scheme:

- Completion of all required deliverables: 4/5
- Each missing/incomplete/illegible deliverable will result in a .5 reduction /5
- Students completing optional deliverables and/or including their own additional experimentation will receive 5/5
- All deliverables including additional explorations should be labeled clearly for grading
- Completion assignments (labs) must be handed in on time or they will receive a 0. The 5% late policy does not apply to labs.

Assessed grading scheme:

Individual grading breakdowns will be included in assignment handouts, however, considerations will always include:

- Completion of the deliverables
- Organization and clarity of the submission
- Demonstration of the techniques covered in the tutorials
- Consideration of the themes covered in the lecture
- Independent inquiry, exploration and development

Grades will be assigned based on the following standard:

0% - 49%	Works fails to meet any expectations
50% - 69%	Significant portions are missing and/or below expectations
70% - 74%	All or most deliverables are met, with portions below the expected level of quality
75% - 79%	All deliverables are met and the level of work is in line with expectations
80% - 89%	All deliverables are met and portions of the work are beyond expectations
90% - 100%	Exemplary work with all facets exceeding expectations

The Living - Project MaRS

REMOTE COURSE DELIVERY PLATFORMS & COMMUNICATION:
During hybrid/remote learning, we will be using additional platforms to deliver, organize and share course content, learning and work. Here is a breakdown of tools we will use in this course:

Teams:
- Live lectures and tutorials
- Archived recordings of lectures and tutorials
- Course documents (assignments, readings, etc.)
- Messaging for informal chats and questions
- Document sharing, sign up sheets, etc.

Learn:
- Submissions
- Grades

Email:
- Formal announcements and communications

Miro:
- Pin-ups, if required

When possible, work sessions and fabrication support will be in person with the option of remote students engaging via Teams and Miro

READINGS:
Short supplemental reading will be provided at key points during the course.

SOFTWARE:
Required:
Rhino 6
Autodesk Recap Photo
Weaverbird for Grasshopper
RhinoCAM Trial

Optional:
Lunchbox for Grasshopper
Human for Grasshopper
Ladybug + Honeybee for Grasshopper

SUBMISSIONS:
All labs and assignments will be submitted on Learn. When possible, please combine files into a single PDF. Large PDFs should be compressed using Acrobat Pro or smallpdf.com.

Late Submissions:
Assignments that are handed in late will receive an initial penalty of 5% on the first calendar day late and a 5% penalty per calendar day thereafter. After 5 calendar days, the assignment will receive a 0%. Please note that if there is a class-wide issue regarding a deadline, it should be communicated to the instructor via the Class Representative(s). Labs are not subject to the 5% penalty, and will receive a 0 if handed in late.

This course relies heavily on technology to complete assignments. Students are expected to work responsibly and carefully so that they can submit assignments on time. Issues such as forgetting to save before a crash or not leaving time for digital processes will not be accepted as reasoning for a late assignment. If students do run into technical issues that hinder a submission, please upload everything you have on time and explain the issue in the submission.

Late Pass:
Students are allocated one late pass for the term. This allows students to make one submission up to **48** hours after the stated deadline without penalty and without any request for accommodation.

Students are required to communicate with your instructor their intention to use a late pass before the relevant deadline. If the pass is used by group, it will count as each student in the group using their pass.

Outside of the late pass, only in the case of a justified medical or personal reason will these penalties be waived, and only if these have been officially submitted to the Undergraduate Student Services Co-Ordinator and accepted by the Undergraduate Office.

Students seeking accommodations due to COVID-19, are to follow Covid-19-related accommodations as outlined by the university here: (https://uwaterloo.ca/coronavirus/academic-information#accommodations).

CULTURE AND GROUP WORK:
This course is designed so that students get more out when they put more in. Curiosity, coming prepared with material, an openness to new technologies and processes, and a commitment to purposeful and ambitious investigation will all lead to success.

Whether assignments are submitted as groups or individuals, the culture of the course will involve plenty of collaboration between students to encourage sharing knowledge, and promote constructive teamwork. You should also always be each other's first resource, before seeking an instructor or TA. By solving problems in groups, you will learn more, and have more meaningful time with the instructor. For projects that involve group work, team members are expected to contribute equally, and will all receive the same grade. If there are concerns regarding a member pulling their weight, please reach out to the course instructor and solution will be discussed.

DIGITAL SUPPORT:
When asking the instructor or TAs for support regarding digital files, place follow these guidelines:
- Include the file(s) in question or a link to download it if it is too large
- Describe the steps you have taken to resolve the issues so far
- Include images and/or notes of what you are trying to achieve

RESOURCES:
Rhino commands: https://docs.mcneel.com/rhino/6/help/en-us/commandlist/command_list.htm
Rhino user manual: https://www.food4rhino.com/resource/rhino-6-users-guide-english
Rhino + Grasshopper plugins: https://www.food4rhino.com
Grasshopper components: https://rhino.github.io/
Grasshopper video tutorials: https://vimeopro.com/rhino/grasshopper-getting-started-by-david-rutten/video/79842791
Grasshopper manual: http://www.liftarchitects.com/blog/2009/3/25/grasshopper-primer-english-edition
V-Ray tutorials: https://www.chaosgroup.com/vray/rhino/tutorial-videos

COURSE TIME ZONE
All dates and times communicated in the document are expressed in Eastern Time. Eastern Standard Time (EST, UTC–05:00) applies November to March and Eastern Daylight Time (EDT, UTC–05:00) applies from March to November.

COVID-19 SPECIAL STATEMENT
Given the continuously evolving situation around COVID-19, students are to refer to the University of Waterloo's developing information resource page (https://uwaterloo.ca/coronavirus/) for up-to-date information on academic updates, health services, important dates, co-op, accommodation rules and other university level responses to COVID-19.

STUDENT NOTICE OF RECORDING
The course's official Notice of Recording document is found on the course's LEARN site. This document outlines shared responsibilities for instructors and students around issues of privacy and security. Each student is responsible for reviewing this document.

All live lectures, seminars and presentations including questions and answers will be recorded and made available through official course platforms (LEARN and/or MS Teams). Students wishing not to be captured in the recordings have the option of participating through the direct chat or question and answer functions in the meeting platforms used.

In-person Activities Planning
If course activities are impacted by a change in restrictions to in-person activities, such as changes in room occupancy limits, the instructor will communicate updated in-person activity plans. These plans may alter student plans for in-person activities.

MENTAL HEALTH SUPPORT
All of us need a support system. We encourage you to seek out mental health supports when they are needed. Please reach out to Campus Wellness (https://uwaterloo.ca/campus-wellness/) and Counselling Services (https://uwaterloo.ca/campus-wellness/counselling-services).

We understand that these circumstances can be troubling, and you may need to speak with someone for emotional support. Good2Talk (https://good2talk.ca/) is a post-secondary student helpline based in Ontario, Canada that is available to all students.

EQUITY, DIVERSITY AND INCLUSION COMMITMENT
The School of Architecture is committed to foster and support equity, diversity and inclusion. If you experience discrimination, micro-aggression, or other forms of racism, sexism, discrimination against 2SLGBTQ+, or disability, there are several pathways available for addressing this:

A) If you feel comfortable bringing this up directly with the faculty, staff or student who has said or done something offensive, we invite you, or a friend, to speak directly with this person. People make mistakes and dealing them directly in the present may be the most effective means of addressing the issue.

B) you can reach out to either the Undergraduate office, Graduate office, or Director (Anne Bordeleau). If you contact any of these people in confidence, they are bound to preserve your anonymity and follow up on your report.

C) You can choose to report centrally to the Equity Office. The Equity Office can be reached by emailing equity@uwaterloo.ca. More information on the functions and services of the equity office can be found here: https://uwaterloo.ca/human-rights-equity-inclusion/about/equity-office.

D) Racial Advocacy for Inclusion, Solidarity and Equity (RAISE) is a student-led Waterloo Undergraduate Student Association (WUSA) service launching in the Winter 2019 term. RAISE serves to address racism and xenophobia on the University of Waterloo campus with initiatives reflective of RAISE's three pillars of Education and Advocacy, Peer-to-Peer Support, and Community Building. The initiatives include but are not limited to: formal means to report and confront racism, accessible and considerate peer-support, and organization of social events to cultivate both an uplifting and united community. You can report an incident using their online form.

ACADEMIC INTEGRITY, GRIEVANCE, DISCIPLINE, APPEALS AND NOTE FOR STUDENTS WITH DISABILITIES:

Academic integrity: In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. [Check the Office of Academic Integrity for more information.]

Grievance: A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Student Petitions and Grievances, Section 4. When in doubt, please be certain to contact the department's administrative assistant who will provide further assistance.

Discipline: A student is expected to know what constitutes academic integrity to avoid committing an academic offence, and to take responsibility for his/her actions. [Check the Office of Academic Integrity for more information.] A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course instructor, academic advisor, or the undergraduate associate dean. For information on categories of offences and types of penalties, students should refer to Policy 71, Student Discipline. For typical penalties, check Guidelines for the Assessment of Penalties.

Appeals: A decision made or penalty imposed under Policy 70, Student Petitions and Grievances (other than a petition) or Policy 71, Student Discipline may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72, Student Appeals.

Note for students with disabilities: AccessAbility Services, located in Needles Hall, Room 1401, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with AccessAbility Services at the beginning of each academic term.

Turnitin.com: Text matching software (Turnitin®) may be used to screen assignments in this course. Turnitin® is used to verify that all materials and sources in assignments are documented. Students' submissions are stored on a U.S. server, therefore students must be given an alternative (e.g., scaffolded assignment or annotated bibliography), if they are concerned about their privacy and/or security. Students will be given due notice, in the first week of the term and/or at the time assignment details are provided, about arrangements and alternatives for the use of Turnitin in this course.

It is the responsibility of the student to notify the instructor if they, in the first week of term or at the time assignment details are provided, wish to submit the alternate assignment.

Week	Date	Concepts	Assignment		Topic	Lab Time	Outside of Class (3hrs)	Assigned	Due @ Start of Class
01	Sept 14	Translations between digital and physical models as moments for design exploration	A01.1: Fabrication Proposal		Course introduction + concepts, photogrammetry	L01: Photogrammetry	L01	A01: Fabrication L01: Photogrammetry	
02	Sept 21				Mesh modeling	L02: Mesh Manipulations	A01	L02: Mesh Manipulations	L01: Photogrammetry
03	Sept 28				Fabrication methods + Model decomposition	L03: Decomposition	A01	L03: Decomposition	L02: Mesh Manipulations
04	Oct 5				RhinoCAM	Worksession	A01		L03: Decomposition A01.1 (Oct 8@10pm)
Break									
05	Oct 19	Parameters, associations and procedures as design drivers	A02: Parametric Study	A01.2: Fabrication Log	Introduction to procedural design	L04: GH intro	A02 / Fabrication	L04: GH Intro A02: Parametric Study	
06	Oct 26				Data structures and manipulation	L05: List Exercise	A02 / Fabrication	L05: List Exercise	L04: GH Intro
07	Nov 2				Smart Associations	Worksession	A02 / Fabrication		L05: List Exercise
08	Nov 9				Troubleshooting	Worksession	A02 / Fabrication		
09	Nov 16	Augmented intelligence through analytical feedback tools + integrated digital design methodologies	A03: Feedback Tool		Analytical tools + plug-ins	L06: Analytical Layer	A03 / Fabrication	L06: Analytical Layer A03: Feedback tool	
10	Nov 23				Special Topic	Worksession	A03 / Fabrication		A02 (Nov23@10pm)
11	Nov 30				Special Topic	Worksession	A03 / Fabrication		L06: Analytical Layer
12	Dec 07				Special Topic	Worksession	A03 / A01.2		A03 (Dec7@10pm)

* Daily course content subject to change

A01.2 (Dec18@10pm)