*Disciplines are defined by groups of objects, methods, and their corpus of propositions considered to be true, the interplay of rules and definitions, of techniques and tools: all these constitute a sort of anonymous system, freely available to whoever wishes, or whoever is able to make use of them, without there being any question of their meaning or their validity being derived from whoever happened to invent them."*

Michel Foucault, *Archaeology of Knowledge*

As a counter to Modernism's proclivity toward specialization and its desire to define and frame those conditions considered to be intrinsic to each discipline, by the end of the 20th century and dawn of the millennium, architecture had substantially expanded the territory of its disciplinary field in two distinct ways. First, through the absorption of a wide range of other disciplinary 'epistemes' (systems of knowledge) into its core, and second, through the expansion of its terrain as its own analytical and design tools migrated into, and were used to re-conceptualize other disciplinary territories seemingly extrinsic to its practice. In this latter context, what renders a problem 'architectural,' is therefore not necessarily that it is specific to a building, but rather that it can be thought and approached through methods, tools and techniques that have evolved within the ever-enlarging discipline of architecture. This double-sided infiltration has tended to blur architecture's disciplinary boundaries, yet has both internally enriched the conceptual, formal and material tools with which architecture operates while simultaneously enabling it to become more engaged with, and a driver of innovation within, an ever-changing world.

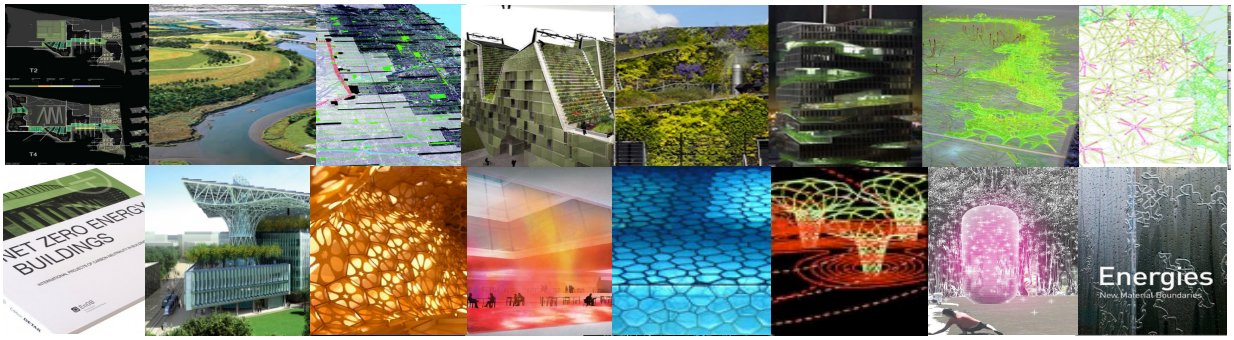
In the last two decades, architectural thought and design has been largely influenced by two dominant trajectories that have been critical to its own reconceptualization: on the one hand, its re-engagement with the natural world through an emphasis on ecological, environmental, material and/or biological paradigms, and on the other hand, the influence that digital, interactive and information technologies have had on changing models of architecture. As digital practices emulate living models and animate patterns of biological growth, and or as green landscape ecologies are being routinely called upon to cloak the surfaces of the future urban agropolis, smooth mixtures are emerging everywhere that start to render ambiguous the traditional opposition of nature and culture, landscape and architecture, the biotic and the mechanistic.

Although historically emerging from distinct milieus that might constitute opposite sides of the nature-culture dialectic, these two larger trajectories, whether considered in isolation, opposition, or through their variant modes of intersection, have thoroughly redefined how we understand architecture as a larger complex system—for example, as a material ecology, an organizational geometry, and/or an information network.

This Thesis Research + Design studio will engage students whose thesis topics might productively intersect with one of the above broadly defined trajectories in relation to new technologies, ecologies, or environments, and who are interested in exploring and interrogating architecture (via either primarily written or design-based research) through its evolving paradigms—in particular, in relation to its generative material, formal/spatial, technological, environmental, ecological, informational and/or computational systems. Thesis projects and research precedents can operate at any scale, including small-scale components and installations, built architectural works, and large-scale infrastructural territories or landscapes.

Under these larger umbrella topics, there are a number of potential themes that, although not a definitive list, might be explored as contexts for individual theses:

*1. Environmental Systems And Artificial Ecologies*
*2 Energy Circuits And Atmospheric Architectures*
*3 Biomimicry And Biomorphism*
*4 Parametric Design, Advanced Visualization, Digital Craft and Non-Standard Modes of Fabrication*
*5 Dynamic Systems And Interactive Architectures*




**1. ENVIRONMENTAL SYSTEMS and ARTIFICIAL ECOLOGIES**

Environmental imperatives, for example, have enabled us to imagine what might constitute the changing material dynamics and fluid exchanges of an architectural or urban metabolism (rather than understanding architecture or the city as a static collection of objects) influencing the development of a number of projects.

From those interested in considering regenerative strategies in design at different scales, this might include the creative recycling of waste— whether thought of as the recycling of territories and infrastructure, such as Field Operation's *Fresh Kills Lifescape* or the *Highline* in New York, the Downsview Park competition, or other projects that look at the transformation of brownfield sites or the recycling of both buildings and materials.

This also includes projects that might be looking at the effects of environmental degradation and ways to think about the productive recircuiting of resources and the development of new synthetic ecological systems and energy or resource producing infrastructures that reshape and dynamically adapt to the populations that they support such as Urbanlab's *Growing Water* project for the city of Chicago, Lateral Office's transformation of the Salton Sea, IwamotoScott's *Hydronet* proposal for San Francisco and BIG's Waste-to-Energy Plant in Copenhagen.

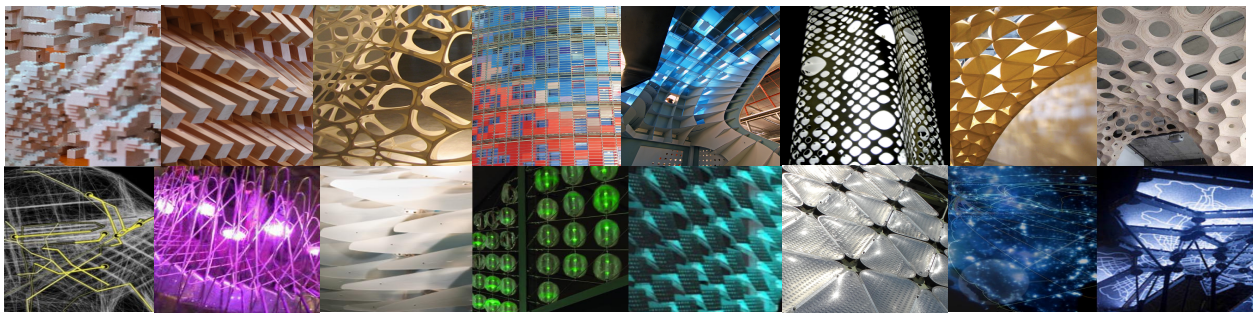
Artificial ecologies might also question what constitutes the limits of the green paradigm, and the new nature-culture relationship within these various biotic-architectural skins, or take on other environmental issues such as the effect of global warming in relation to rising tides such as LTL's amphibious landscape for New York as part of the *Rising Currents* exhibition.

**2 ENERGY CIRCUITS AND ATMOSPHERIC ARCHITECTURES**

Energy circuits might focus on the complex exchanges and economies of energy, from Net Zero Energy architectures to those, like Philippe Rahm, that consider the flows, atmospheric effects and sensory experiences of the micro-environments that we create, as primary material constituents— along with concrete, steel, and glass—of buildings and cities. Sean Lally asks us to envisage architecture, not only as a physical extension of the geological crust of the earth's surface, but also as the bottom layer of an 'ocean' of air, and to invest the same degree of design intelligence into organizing these thermodynamic and atmospheric milieus.

**3 BIOMIMICRY AND BIOMORPHISM**

As a third theme, that operates at the nexus between technology and the natural world, we find a wide range of bio-mimetic and biomorphic models, from scripted architectures that evolve from a gene code to those whose form and/or various functions are derived from biological models. Our revived fascination with the "living" and the desire to establish new linkages across the nature-culture divide has been one of the strongest trajectories that we have encountered in recent years, despite the fact that the design territories and approaches that have been developed are as diverse as the natural systems they seem to emulate. Whether it is the digitization of the golden gate forest canopy that inspires the skin of the deYoung Museum, foaming water and soap bubble minimal geometries that become a precedent for the development of the watercube Olympic swimming pool enclosure, or the micro-filaments of a lobster's exoskeleton that provided the generative research model for the woven structure of Achim Menges's ICD/ITKE Pavilion in Stuttgart.



## 4 GENETIC SYSTEMS: PARAMETRIC DESIGN, ADVANCED VISUALIZATION AND DIGITAL CRAFT / NON-STANDARD MODES OF FABRICATION

And while the eco-logics of architecture extends our thinking about the environment by asking us to re-conceptualize architecture itself through ecological or biological models—to imagine it as a dynamic, integrative and interconnected system— in a distinct, yet parallel trajectory, digital technologies have evolved from being simply representational tools invested in the depiction and elaboration of existing models of architectural space to becoming significant performative and computational machines that have transformed the ways in which we both conceive and configure form, space and material.

From the proliferation of pixelated buildings skins, such as and Jean Nouvel's Agbar Tower in Barcelona and Gramazio & Kohler's robotically-built walls of the Gantebien winery, that seem to mimic the underlying architectural logic of our computer screens (where in the winery the rotation of bricks is based on the shifting grayscale image of a basket of grapes), to parametrically designed objects, buildings, cities and landscapes—such as MVRDV's Delft Housing Study or Porous City Project, Matsys's P_Wall, or Reiser + Umemoto's Shenzhen airport—whose computational design processes often emulate the genetic and iterative evolutionary developments in living systems, these new technologies have not only radically changed the ways in which we integrate disparate types of material information into the design process, but have also significantly altered the methodological strategies that we use in both design and fabrication, expanding the formal, geometric and material territories of architectural practice. As Vouissor Cloud reconceives the overlay of catenary structures and the traditional vault using paper-thin wood veneer, Matter Design also rereads historical stereometric building forms using new materials, geometries and technologies.

## 5 DYNAMIC SYSTEMS AND INTERACTIVE ARCHITECTURES

As the development and use of these technologies within architecture has enabled a new relationship to the animate and biotic that has far exceeded earlier mechanistic models, they have also generated techniques and tools that have allowed us to both understand architecture and environments as complex multi-agent networks—dynamic systems with embedded forms of intelligence and new sensory, responsive and performative capacities.

The effects of these developments on the discipline—which have produced changing models for understanding matter, media, form, space, technology and territory—are perhaps as significant to the evolution of contemporary architectural practice as the overlay of Cartesiansim, industrial production, and social political models was to the generation of modern architecture. That our current models of space are far more continuous, variant and complex, for example, is specifically a result of the conceptual frameworks, methodologies and tools we are using to produce them, an inevitable byproduct of the ever-expanding and evolving territories of architecture that long ago dismantled the social, functional and technological truths of the early part of the 20th century.

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## SEMESTER Schedule Fall 2015:

| MONTH | WEEK | TUESDAY | THURSDAY |
|---|---|---|---|
| **SEPTEMBER**<br>Orientation Week | **0** | | **9/9 This is a Wednesday**<br>**TRD1 PRESENTATION + INTRODUCTION 1:30 [ML]**<br>Lottery Umbrella Topics |
| Classes Begin | **1** | **9/15**<br>**S1 CONCEPTUAL FRAMEWORK// THESIS CLOUD**<br>Discussion "What is a Thesis" [?]<br>Hand-out Assignment A1 | **9/17**<br>**W1 LITERATURE SEARCH WORKSHOP [EC]**<br>Effie Patelos [UW Musagetes Library] 10:00 - 12:00<br>**DESK CRITS**<br>02:00 - 04:00 Academic Integrity and Ethics [ML]<br>01:00 - 02:00 All School Meeting [ML] |
| **DATAlab Drone Workshop**, 21/9, 5-8 [Frank Sedlar]<br>**InDesign Workshop,** 21/9, 8-9 [El Khafif, Van Leur] | **2** | **9/22**<br>**DESK CRITS** | **9/24**<br>**DESK CRITS** |
| | **3** | **9/29**<br>**S2 PRECEDENTS// DESIGN STRATEGIES**<br>Internal Review A1, Hand-out Assignment A2 | **10/01**<br>**DESK CRITS** |
| **OCTOBER**<br>Drop/no penalty period ends 02/10 | **4** | **10/06**<br>**DESK CRITS** | **10/08**<br>**DESK CRITS** |
| | **5** | **10/13**<br>**S3 LITERATURE RESEARCH**<br>Internal Review A2, Hand-out Assignment A3 | **10/15**<br>**W2 LITERATURE REVIEW WORKSHOP [EC]**<br>Effie Patelos [UW Musagetes Library] |
| | **6** | **10/20**<br>**DESK CRITS** | **10/22**<br>**L2 GUEST LECTURE DESIGN RESEARCH [NN]**<br>Before and afterwards Desk Crits |
| | **7** | **10/27**<br>**S4 SITE ANALYSIS**<br>Hand-out Assignment A4 | **10/29**<br>**W3 WORKSHOP** [Bridge, Ward Room, 226, Founder's Lounge] |
| **NOVEMBER** | **8** | **11/03**<br>**W3 WORKSHOP** [Bridge, Ward Room, 226, Founder's Lounge] | **11/05**<br>**DESK CRITS** |
| | **9** | **11/10**<br>**MID REVIEW [L]**<br>Presentation of A1-A4 | **11/12**<br>**S5 PROGRAM// TEST DRIVE**<br>Hand-out Assignment A5 |
| | **10** | **11/17**<br>**DESK CRITS** | **11/19**<br>**DESK CRITS** |
| | **11** | **11/24**<br>**DESK CRITS** | **11/26**<br>**DESK CRITS** |
| **DECEMBER**<br>Classes and Lectures end 04/12 | **12** | **12/01**<br>**DESK CRITS** | **12/03**<br>**DESK CRITS** |
| | **13** | **12/08**<br>**S6 ARGUMENT//THESIS OUTLINE**<br>Assignment A6 | **12/10**<br>**Final Review Prep**<br>*Exams Start*<br>**12/11**<br>**FINAL REVIEW [L]** |
| | **14** | **12/15** | **12/17**<br>**THESIS OPEN STUDIO [Bridge Storefront]**<br>Digital and Poster Submission |
| Grades due 08/12-03/01 | **15** | **12/22**<br>**DIGITAL SUBMISSION A1-A6**<br>*Exams End* | **12/24**<br>**Winter Break** |

*The schedule is open for adjustments. Please see schedule announced in assignments. Changes will be discussed during class time. Further information: http://gradcalendar.uwaterloo.ca/page/GSO-Academic-Deadlines-and-Events*

***ML= Main Lecture Hall, EC= Eclass, FL= Founder's Lounge, L= Loft, WR= Ward Room, 226= Seminar Room 226***

**THESIS RESEARCH + DESIGN 1 OBJECTIVES AND STRUCTURE**

This Thesis Research + Design studio/seminar will guide students in the development of an individualized research topic as a preparation for their thesis in architecture. The course will aid students in the generation of written, verbal and visual presentations to develop a critical argument that sets the stage for, and initiates the thesis research project culminating in the production of a thesis outline at the end of the semester.

The course's goals and learning objectives will be supported by an assignment structure and can be described as:

- The formulation of a focused research agenda and questions within the selected topic
- The development of an intellectual and critical method to achieve the thesis proposal
- An understanding of ideas and strategies contained in critical precedents through the generation of methods for their analysis
- The development of methods to research, analyze and understand the environmental context of the site(s) of the thesis
- The development of expertise in history and theory published on the given topic
- The development of an original thesis that is grounded in the discipline

**TRD1 COURSE STRUCTURE // PHASES**

The Thesis Research and Design 1 studio will be taught twice a week on Tuesdays and Thursdays from 10:00am to 6:00 pm. Within the period of 15 weeks students will work on 6 sequentially titled projects [S1 to S6] that will operate as a methodical framework to achieve the class objectives which include the development of an independent thesis topic, an in-depth review of relevant literature, the analysis of precedents critical to the thesis, the documentation and analysis of the environmental and physical context(s) for the thesis, the generation of a thesis program, and the development of a thesis argument. Each of the 6 sequences is accompanied by a 2 or 3 week assignment that allows students to work on their own topic while following a methodical roadmap. The work produced for the assignments are critical components of the thesis and its development. Each assignment is introduced through a lecture and will be discussed as a group. Individual desk crits and group discussions will provide feedback for students to develop their individual projects. The results of the assignments will be discussed during review sessions that are scheduled for Tuesdays. During the semester the course will be enriched by round table discussions, guest lectures, readings and software and other workshops.

Sequence S5 will conclude with a final review (12/11) titled "Thesis Talks." During this review students will pin-up their semester's work and give a 20-30 minute presentation on their thesis research to external guests. The resulting feedback will help to synthesize the semester's work into a final thesis abstract book [S6/A6] that will be submitted to the instructor and that will serve as a roadmap for the student for the following semester (TRD2). During this final thesis research + design sequence, it will be critical to articulate a clear and focused thesis question, a summary of the research completed—literature review, precedent analyses, preliminary site documentation/analysis, program development—that demonstrates a level of expertise on the topic, an analysis of the findings, an articulation of initial design implementations, and a complete outline of the individual thesis syllabus. The semester will end with a social event titled "TRD Open Studio", in which students will present a summary poster of their semester's work to their peers to introduce their thesis research work to the Waterloo Architecture Grad Program.

**TRD1 ASSIGNMENT STRUCTURE //**

Throughout the semester, students will complete 6 assignments, each of which will develop a component of their thesis research and that collectively will generate a critical body of work for the final thesis abstract book. It is assumed that by the end of TRD1, students will not only have completed their preliminary thesis research, but will also have completed 35%-40% of the work for their final thesis research project.

**Sequence S1_THESIS CLOUD: CONCEPTUAL FRAMEWORK //**

An architectural design thesis requires students to formulate a tightly focused research agenda within the discipline of architecture / urbanism and to test this agenda through a specific design proposal in a second stage that follows the first Thesis Research and Design studio. Though the thesis will ultimately employ the tools of architectural production and will be centered on a narrowly focused question founded on an explicit body of research, the first assignment in S1 will ask students to embed their initial thesis thoughts into a larger context. Allow yourself to open your mind and diversify your interests, spread your net and capture a wide range of sources within and outside the conventional architectural discourse. Create a thesis cloud that will offer a landscape of ideas, thoughts, concepts, precedents, theories and affiliations from within and outside of architecture. *Hand-out: Assignment A1*

**Sequence S2_PRECEDENT ANALYSIS //**
As noted by Foucault in the excerpt from the *Archaeology of Knowledge* above, disciplines are defined by the groups of objects (as well as their techniques, methods and meanings), that serve as exemplary models or precedents, to be researched, documented and carefully analyzed. Your thesis project will not stand alone, but rather should be situated within a larger conceptual context of meaningful precedents drawn from within (or outside of) the discipline. Research and understanding that is directly derived and obtained from the close and rigorous investigation of existing design models or physical artifacts is as important (or perhaps more important) than literature about these artifacts. The former can be considered primary knowledge, while the latter draws from the expertise of others to support the analysis and is therefore dependent on the relative value of the contributed text, and the level of expertise and the legitimacy of the author. In relationship to your thesis interests you should ask who has worked on similar topics or engages these concepts in their work? What are the critical projects that have engaged these topics and have tested them through design? What are the precedents you need to understand in order to contribute to the broader discussion about your chosen topic within the discipline of architecture? And through the careful analysis of these precedents, what are the operative strategies, methods, tools/techniques, and concepts embedded in these precedents that might be best suited for your own thesis approach? These methodologies should be extracted, manipulated and transformed to become usable techniques applicable to your own research.
*Hand-out: Assignment A2 [this will be undertaken in concert with the Precedent Analysis from the Arch Analysis course]*

**Sequence S3_CONTEXTUAL RESEARCH // LITERATURE REVIEW**
The literature review sequence, which will include a literature review workshop conducted by Waterloo Architecture Librarian, Effie Patelos, will enable you to construct a more comprehensive conceptual context for your thesis and allow you to dive deeper into your research by conducting an in-depth literature search and review. During this process you will generate a comprehensive bibliography for your thesis research and select 6 critical sources from this search that are specific to, and relevant for your work. You will be asked to generate text summaries of these important sources to clarify your understanding of them and develop a catalogue of 5-10 significant terms/concepts that will act as theoretical and conceptual tools. In this process you will also develop generative and operative methodologies for your thesis—strategies for design, analysis and tool development—drawn both from your theoretical texts (their concepts/ideas), and from the analysis of your precedents. The outcome of this investigation will produce a reworked thesis diagram from A1 that you will now understand as an 'abstract machine' through which to develop your thesis. This 'theoretical machine' will be redefined and developed throughout sequences 4 through 6, incorporating site/environmental context, data and program.
*Hand-out: Assignment A3*

**Sequence S4_SITE + ENVIRONMENTAL ANALYSIS //**
Although your site might not yet be fully defined or you might be working on multiple sites, the fourth sequence will begin to document, map, diagram and analyze the physical environment—urban and/or natural—where your thesis might be located. For students studying larger environmental issues, this analysis might include all of the environmental influences that make up the larger metabolism or ecology within which your project is situated. During this sequence, you will also have the opportunity to learn software tools such as GIS that can help to compile site- and context-relevant data and to analyze these as part of your research. [see annex workshops]. The assignment will consist of multiple components including the development of a digital archive, analytical maps, diagrams, and datascapes.
*Hand-out: Assignment A4 [this assignment will be undertaken in concert with the Site/Environmental/Contextual Analysis from the Arch Analysis course]*

**Sequence S5_PROGRAM // DESIGN APPLICATION [TEST DRIVE]**
Sequence 5 will focus on the development of your thesis program, understood broadly to define the users/use, audience, occupation, performance, functions, and/or choreographies that are intrinsic to your thesis topic and project. This assignment will develop methods to map and diagram the temporal context of the project, which might also include generative and formative processes, or those specific to its fabrication, as well as its choreographies of use, and its performative aspects. The emphasis of this sequence will depend on the specific focus of your thesis and the ways in which it might be understood to operate, function or be "programmed." As a second component of this sequence, you will also be asked to become performative yourselves, by shifting your emphasis from research and analysis to design by actively using the tools, techniques and operative strategies that you have developed and to apply these to the generation of your thesis project through a "test drive."
*Hand-out: Assignment A5*

**Sequence S6_THESIS ARGUMENT // OUTLINE**
The final assignment will ask you to compile all of the research that you have completed into a deeply grounded thesis abstract/outline. This outline will include the articulation of a clear thesis statement (your thesis 'argument' or proposition) and a detailed plan that describes how you are planning to continue working on your project during the next phases (TRD2+). This

outline will operate as your own self-generated syllabus and will help you to structure the continuation of your research and design work that will follow in the next months. *Hand-out: Assignment A6*

*The phases summarized above will be updated by formal assignments (A1-A6) issued throughout the term. Details shown here may change according to the development over the semester and students' needs.

**TRD1 PARTICIPATION AND STUDENT INVOLVEMENT//**

Active individual and group participation is required as part of the semester's work, and to this end students are expected to not only complete the phases of the Thesis Research and Design Studio sequence in a timely manner, but to also actively and continuously participate in discussions, readings and pin-ups throughout the semester. Although students are focused on individual thesis projects, the 'umbrella' topic of TRD1 enables students to not only share resources and readings, but also engage in a critical discussion of the issues being addressed within the studio/seminar. The "life" of any course is dependent on the active involvement on the part of all of the students and it is hoped that each of you will bring to the studio energy, enthusiasm, and a questioning, open mind. Additional workshops and guest lectures will also be organized as part of the TRD1. These experts visiting the class are a tremendous resource for your research and you should each take advantage of the opportunities available to you. I would also encourage all of you to make suggestions for additional workshops, lectures or external critics that you believe would enrich the studio experience or to organize round table discussions that you feel would be beneficial to the development of the course.

**TRD1 DOCUMENTATION AND LEARNING RESOURCES//**

The class will be organized through the pbworks wiki workspace: http://TechnologiesEcologiesTRD1.pbworks.com. Students are invited to organize their own blogs in order to communicate their research with the broader public. This blog will be understood as a growing entity and resource that will help to structure the outline of students' respective thesis projects.

**Research Citations:**

Students are asked to properly and consistently quote and cite work developed by others. Please use the Chicago Manual of Style for these purposes. More information under http://www.chicagomanualofstyle.org/tools_citationguide.html

**TRD1 Research Book:**

In addition, you will be asked to complete the semester with a thesis research book, printed through Lulu Print. The class will have access to a template [US letter] that can be manipulated for personal purposes. However, the format of the final book will be limited to 11" x 8.5" portrait. This book will include all findings and assignments of the semester and will operate as your individual "thesis guide", supporting the next phase of your project. At the end of the thesis completion we intend to publish all final thesis work in form of a thesis publication printed with Riverside Press in Waterloo.

**BIBLIOGRAPHY**

Individual research bibliographies are determined by each student and are understood as a "growing" database that is collected over the duration of the semester. These bibliographies will be constitute the initial conceptual and research framework for each student's thesis and will help develop their research agenda. Under the guidance of the instructor, students will build their bibliography, which is expected to consist of books, essays, documentaries, interviews and online resources. Students are asked to visit the library on a regular basis and to use online archives such as http://www.jstor.org for scholarly research.

In addition, readings will be assigned during the semester, including the following:

**THESIS RESEARCH READINGS**

- Manuel Gausa, Dynamic Time – [in]formal order: [un]disciplined trajectories, in Quaderns 222: Elastic Time by Actar Editors, Barcelona 1999
- Stan Allen, "Mapping the Unmappable". *On Notation, in Practice: Architecture and Representation*, NL, 2000
- Manuel De Landa, "Uniformity and Variability. An Essay in The Philosophy of Matter," http://www.t0.or.at/delanda/
- Sanford Kwinter, "Landscapes of Change", ed. Umberto Boccioni, in Assemblage, No. 19, pp. 50-65, MIT Press, 1992
- Antoine Picon, "Architecture, Science, Technology and the Virtual Realm," in *Architecture and Sciences: Exchanging Metaphors*, ed. Antoine Picon + Alessandra Ponte PAPress, 2003, p. 292-313

Note: Recommended Readings and Supplementary Texts will be included in assignments. Below is a summary bibliography in different topic areas to aid students in the development of their own thesis bibliographies and research agendas. Additional critical sources and other resources will be added and listed on the pbwiki page.

**TOPIC AREAS: RECOMMENDED and SUPPLEMENTAL BIBLIOGRAPHY**

**General: Research / Writing**

Linda Groat and David Wang, *Architectural Research Methods* (New Jersey: Wiley, 2013).
Alexandra Lange, *Writing About Architecture: Mastering the Language of Buildings and Cities* (New York: Princeton Architectural Press, 2012).
Kumar, R. *Research Methodology: a step-by-step guide for beginners.* (London: Thousand Oaks: Sage, 2005)

**New Technologies/Ecologies Background Texts**

Alexander, Christopher, *Notes on the Synthesis of Form.* (Cambridge: Harvard University Press, 1964).
Bateson, Gregory. *Steps to an Ecology of Mind.* (San Francisco: Chandler, 1972).
Berman, Ila and Ed Mitchell [eds], *New Constellations / New Ecologies*, (Proceedings of the 101st International ACSA Conference, San Francisco, 2013)
De Landa, Manuel. *A Thousand Years of Nonlinear History*. (New York: Zone Books, 1997).
De Landa, Manuel. *Intensive Science and Virtual Philosophy*. (London: Continuum, 2002).
Deleuze, Gilles and Felix Guattari. *A Thousand Plateaus.* Brian Massumi trans. (Minneapolis: University of Minnesota Press, 1987).
Kuhn, Thomas. *The Structure of Scientific Revolutions.* (Chicago: University of Chicago Press, 1973).
Latour, Bruno. *Science in Action: How to Follow Scientists and Engineers through Society* (Cambridge: Harvard University Press, 1987).
Mau, Bruce. Leonard, J. Institute Without Boundaries, *Massive Change*, Phaidon Publisher, 2004)
Reiser + Umemoto, *Atlas of Novel Tectonics* (New York: Princeton Architectural Press)
Sheppard, Lola and David Ruy [eds], *The Expanding Periphery and the Migrating Center* (Proceedings of the 103th International ACSA Conference, Toronto, 2015)

**Diagrammatic Approaches to Analysis**

Allen, Stan "Diagrams Matter." *Diagram Work.*
Deleuze, Gilles "The Diagram." *Francis Bacon: The Logic of Sensation.*
Garcia, Mark, "Introduction: Histories and Theories of the Diagrams of Architecture." in *The Diagrams of Architecture.*
Klanten, R. Bourquin, N. Ehmann, S. Van Heerden, F., *Data Flow: Visualizing Information in Graphic Design*, Gestalten Verlag, 2008
Vidler, Anthony, "Diagram of Diagrams: Architectural Abstraction and Modern Representation." in *The Diagrams of Architecture.*
Zaera-Polo, Alejandro, "Between Ideas and Matters: Icons, Indexes, Diagrams, Drawings, and Graphs" in *The Diagrams of Architecture*

**Parametric Design / Computation and Architecture**

Armstrong, Rachel and Simone Ferracina. *Unconventional Computing: Design Methods for Adaptive Architecture*. Cambridge: ACADIA / Riverside Architectural Press, 2013.
Burry, Jane, and Mark Burry. *The New Mathematics of Architecture*. (London: Thames & Hudson, 2010).
Burry, Mark. *Scripting Cultures: Architectural Design and Programming*. (London: Wiley, 2011).
Garcia, Mark. *Patterns of Architecture*. (London: John Wiley, 2009).
Gengnagel, Christoph, Axel Killian, Norbert Palz, Fabian Scheurer eds. *Computational Design Modeling.* (Berlin: Springer-Verlag, 2011)
Hensel, Michael. *Emergence: Morphogenetic Design Strategies*. (London: Wiley, 2004).
Katherine Hayles. *How We Think: Digital Media and Contemporary Technogenesis.*
Kolarevic, Branko and Kevin Klinger. *Manufacturing Material Effects: Rethinking Design and Making in Architecture*. (New York: Routledge, 2008).
Kolarevic, Branko. *Architecture in the Digital Age: Design and Manufacturing*. (New York: Spon, 2003).
Lars Spuybroek, *Research & Design: The Architecture of Variation*. (New York: Thames & Hudson, 2009).
Leach, Neal, D. Turnbull and C. Williams, *Digital Tectonics.* (Chichester: Wiley, 2004).
Leach, Neil, *Designing for a Digital World*. (London: Wiley, 2002).
Lisa Iwamoto. *Digital Fabrications: Architectural and Material Techniques.* (New York: Princeton Architectural Press, 2009).
Ludger Hovestadt and T. Danaher. *Beyond the Grid: Architecture and Information Technology.* (Birkhauser Verlag, 2009)
Lynn, Greg ed. *Archaeology of the Digital.* (Montreal: Canadian Center for Architecture, 2013).

Menges, Achim and Sean Alquist, *Computational Design Thinking*. (London: John Wiley & Sons, 2011).
Rahim, Ali, *Contemporary Processes in Architecture*. (Bognor Regis: Wiley, 2000).
Sakamoto, Tomoko. *From Control to Design: Parametric/algorithmic Architecture*. (Barcelona: Actar-D, 2008).
Schumacher, Patrik. *The Autopoesis of Architecture*
Terzidis, Kostas. *Algorithmic Architecture*. (Oxford: Architectural Press, 2006)

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