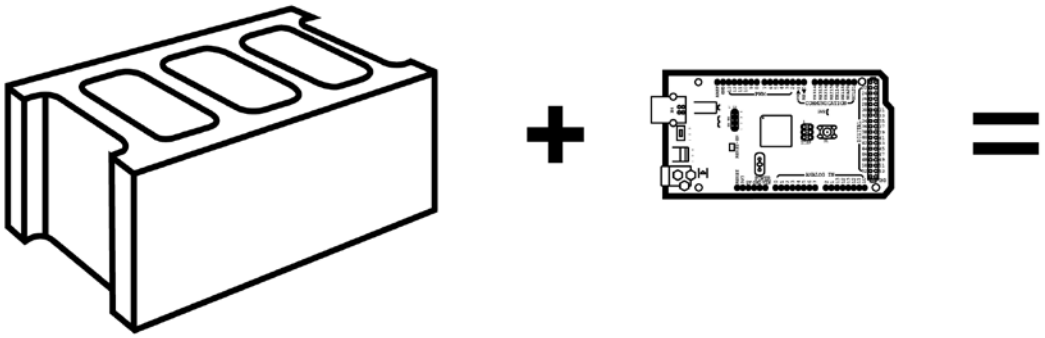
Designing for the Internet of Things – Architecture in the Cloud

Course: ARCH 684_004 Spring
Time: Monday/Thursday // June 23rd - July 28 // 10:00a.m. -1:00p.m
Room: 2026

Instructor: Christos Marcopoulos, RAD (University of Toronto) and NMinusOne
Contact: christos@nminusone.com



Introduction

Through the integration of small computing, sensing and actuating devices into the physical realm, architecture is confronted with the possibility of becoming sentient -- moving away from a static, inert state, into one capable of dynamic responses. These technologies offer the potential for sensitizing matter to respond and adapt to the inhabitant as well as to changing environmental conditions. The idea that an object can now think, act and communicate is opening up the potential for an architecture that is more closely aligned with the dynamics of social human ecologies inviting in turn the possibility of an architecture, in which every building block becomes a networked social participant in the construction of a spatial and environmental condition.

The seminar will take on the architectural element. It will explore its cultural and material evolution, and its potential future as an active participant in the cloud.

Course Objectives

The seminar enables students to explore models of research and practice in architecture and urban design that are shaped by embedded technology and ubiquitous computing. They are examined in the context of a broad intellectual landscape that includes art, technology, geography, environmental studies, social sciences, media studies, economics and engineering.

The seminar is organized thematically around key issues in the emerging fields of embedded technology and ubiquitous computation. It also examines technologies and techniques that will enable a hands-on approach in modest design projects for the Internet of Things: a world where objects, buildings and people become increasingly connected in a network of communication.

Design / Research

The course is a Design/Research Seminar. Research is used to understand a particular design problem. In the process we will engage with both historical and contemporary issues, but always with respect to the design problem at hand. Students need to bring their laptops to class. Class time will be used for: presentations, discussions, brainstorm sessions, design sessions, along with research and production.

Deliverables

Format: 8 ½ x 11, Portrait, InDesign and PDF
Font: Calibri, Title: 14pt, Body: 11pt. Caption: 10 pt
Drawing: exploded axonometric: NTS, Black line, Illustrator
Images: Jpeg or TIFF, 300 dpi
References and citations to be included

Methodology - Process:

1) **Element Selection**
    i. an architectural element
2) **Element Analysis**
    i. Historical Analysis – time line(s) [images, seminal moments]
    ii. Physical Analysis – case studies, components, enabling capacity, variation [exploded axon drawings]
    iii. Data Analysis – engage with an object-oriented perspective: what does the element have access to? what does it feel? what network is it a part of? what does it interface with or mediate?
3) **Element Soft Analysis**
    i. Primary user analysis
    ii. Developer analysis
    iii. Developers' customer
4) **Element Design Probes**
    i. Activation of latent potential
    ii. Element gains new capacity
    iii. Production of three proposals for activating element or object
    iv. Element/Object becomes part of network
5) **Element Design**
    i. Plans
    ii. Sections
    iii. 3D models
    iv. Exploded Axonometric
    v. User maps
    vi. Object maps
    vii. Diagrams
    viii. Animations
    ix. Scripts
    x. Anticipatory scenarios
6) **Reinsertion of Element into Hypothetical/Future Reality**

Schedule:

Week 1:
Monday June 23rd
Introduction: Internet of Things
Element Selection
Thursday June 26th
Element analysis

Week 2:
Monday June 30th
Canada Day Holiday – NO CLASS
Thursday July 3rd
Review – Discussion - Work

Week 3:
Monday July 7th
Element Analysis Continued – Soft Analysis:
Thursday July 10th
Review – Discussion - Work

Week 4:
Monday July 14th
Activation of Latent Potential
Thursday July 17th
Review – discussion - Work

Week 5:
Monday July 21st
Design Element:
Thursday July 24th
Reinsertion of Element in Hypothetical/Future Reality
Finish Book Chapter – Consolidate Book

Week 6:
Monday July 28th
Final Reviews – Discussion

Evaluation

- Participation: 20% of final grade
- Class Participation: 30%
- Final Project: 50%

Late Work

All assignments are due in class at the specified time and date. Late submission will result in a 5% deduction (of each assignment's total grade) per business day, excluding weekends. In the case of illness or other special circumstance, notification should be given to the instructors and the Program Office as soon as possible and before the deadline in question.

Late work submitted after the final due date is not acceptable without prior written permission from the Program Director

Bibliography:

Group A:

Daniel Suarez, Daemon, Verdugo Press, December 1st 2006

Daniel Suarez, Kill Decision – A Thriller, Penquin Group, July 19th, 2012

Valentino Braitenberg, *Vehicles – Experiments in Synthetic Psychology,* Bradford Book, 1986

Chris Anderson, *Makers – The New Industrial Revolution,* Crown Business, 2012

Jacques Ellul, *The Technological Society*, Vintage Books, 1954

Norbert Wiener, *Cybernetics: or Control and Communication in the Animal and the Machine,* 1948

Neal Stephenson, *Snow Crash*, Bantam Books, June 1992

Manual Castells and Peter Hall, *Technopoles of the World, Making of 21st Century Industrial Complexes*, Taylor and Francis Group, 1994

Raymond Kurzweil, *The Singularity is Near – When Humans Transcend Biology*, Penquin Books, 2005

Peter Semmelhack, *Social Machines*, Wiley, 2013

Greenfield, Adam, *Everyware: the Dawining Age of Ubiquitous Computing,* New Riders Publishing, 2006

Group B:

Mark Shepard ed., Sentient City: Ubiquitous Computing, Architecture, and the future of Urban Space, (Cambridge: The MIT Press, 2011)

Philip Beesley, Sachiko Hirosue, Jim Ruxton, Marion Trankle, Camille Turner, eds., *Responsive Architectures: Subtle Technologies*, (Cambridge: Riverside Architectural Press, 2006)

Lucy Bullivant, *Responsive Environments: architecture, art and design,* (London: Victoria and Albert Museum, 2006

Cassimalli, Hakim and McEwan, Adrian, *Designing the Internet of Things*, 2013

Michael Fox*, Interactive Architecture*, (New York: Princeton Architectural Press, 2009)

Burke, Anthony and Thierny Therese, *Network Practices*, Princeton Architectural Press

Pfister, Cuno, *Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers to the Cloud*, 2012.

Picon, Antoine, *Digital Culture in Architecture*, Birkhauser, 2010.

Barabasi, Albert-Laszlo, *Linked; How Everything is Connected to Everything Else and What it Means,* Plume, 2003.

Rodolphe el-Khoury, Christos Marcopoulos and Carol Moukheiber, *The Living, Breathing, Thinking Responsive Buildings of the Future,* Thames & Hudson, 2012.

Group C:

Buchanan, Mark, *Nexus: Small Worlds and the Groundbreaking Science of Networks*, Norton, 2002.

Castells, Manuel, *The Rise of the Network Society,* Blackwell Publishers, 2000.

Chaouchi, Hakima, Ed., *The Internet of Things: Connecting Objects*, Wiley, 2010

Corby, Tom, *Network Art: Practices and Positions,* Routledge, 2006

De Kerckhove, Derrick, *The Architecture of Intelligence*, Birkhauser Publishers, 2001.

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De Landa, Manuel, *A Thousand Year of Nonlinear History,* Zone Books, 1997

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Friedman, Thomas L., *The World is Flat: A Brief History of the Twenty-first Century*, Farrar, Straus, and Giroux, 2005.

Gershenfeld, Neil, *FAB: the Coming Revolution—from Personal Computing to Personal Fabrication,* Basic Books, 2005

Gladwell, Malcolm, *The Tipping Point, Or How Small Things Can Make a Big Difference, Back By Books*, 2002

Hansen, Mark, *New Philosophy for New Media, MIT Press, 2004*

Johnson, Steven, *Emergence: The Connected Lives Of Ants, Brains, Cities, and Software,* Scribner, 2002.

Johnson, Steven, *Interface Culture : How New Technology Transforms the Way We Create and Communicate,* HamperEdge, 1997

Kelly, Kevin, *Out of Control, the Rise of Neo-Biological Civilization,* Addison-Wesley, 1994.

Kolarevic, Branko, *Performative Architecture; Beyond Instrumentality,* Spon Press, 2005

Kolarevic, Branko, *Architecture in the Digital Age: Design and Manufacturing,* Spon Press, 2003

Kwinter, Sanford, *Architectures of Time,* MIT Press, 2002

Lovejoy, Margot, *Digital Currents; Art in the Electronic Age,* Routledge, 2004

Malcom McCollough, *Ambient Commons: Attention in the Age of Embodied Information*, 2013.

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Massumi, Brian*, Parables for the Virtual*, Duke University Press, 2002.

Mitchell, William J., *Me++,The Cyborg Self and the Networked City*, The MIT Press, 2004.

Mitchell, William, *e-topia*, MIT Press, 1999.

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Strogatz, Steven, *Sync: How Order Emerges From Chaos in The Universe, Nature, And Everyday Life,* Hyperion, 2004

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Townsend, Anthony, *Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia,* 2013.

Watts, Duncan, *Six Degrees; The Science of a Connected Age,* Norton, 2003

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 https://uwaterloo.ca/academic-integrity/ for more information.]

Grievance

Students, who believe that a decision affecting some aspect of their university life has been unfair or unreasonable, may have grounds for initiating a grievance. Students should read Policy #70, Student Petitions and Grievances, Section 4. When in doubt, students must contact the department's/school's administrative assistant who will provide further assistance.

Discipline

Students are expected to know what constitutes academic integrity, to avoid committing academic offenses, and to take responsibility for their actions. Students who are unsure whether an action constitutes an offense, or who need help in learning how to avoid offenses (e.g., plagiarism, cheating) or about 'rules' for group work/collaboration should seek guidance from the course instructor, academic advisor, or the Associate Dean of Science for Undergraduate Studies. For information on categories of offenses and types of penalties, students should refer to Policy #71, Student Discipline. For information on typical penalties, students should check Guidelines for the Assessment of Penalties.

Appeals

A decision or penalty imposed under Policy 33 (Ethical Behavior), Policy #70 (Student Petitions and Grievances) or Policy #71 (Student Discipline) may be appealed, if there is a ground. Students, who believe they have a ground for an appeal, should refer to Policy #72 (Student Appeals).

Note for Students with Disabilities

Accessibility Services, located in Needles Hall, Room 1132, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If students require academic accommodations to lessen the impact of their disability, they should register with Accessibility Services at the beginning of each academic term.

Accommodation

Should students require accommodation due to illness, they must provide a Verification of Illness Form to support their requests. [Check https://uwaterloo.ca/registrar/ current-students/accommodation-due-to-illness for more information.]

Exam Period Travel

Student travel plans are not considered acceptable grounds for granting an alternative examination time.