ARCH 684_002: MATERIAL ECOLOGIES

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Monday, 10 AM – 1 PM, Arch 2026
Office Hours: Monday 2-4 PM
(rev. 161017)

"We can no longer be innocent about materiality, nor can we assume for materials a natural or absolute status." (Sheila Kennedy, 2001)

"Inevitably, all organisms use materials: that is the essence of metabolism." (Vaclav Smil, 2014)

Photograph: Filippo Poli, Expo Dismantling, Milano, 2016

DESCRIPTION

The materials of architecture and landscape architecture structure enclosures and terrain, produce sensorial and performative environments, interact with water, species, and other ephemeral forces, and often, convey ideas about human relationships with the non-human world. At the same time the use of these materials *is* an example of how humans alter landscapes through extraction and use of minerals, plants, and fuels for urbanization. This course looks at the relationship between materials as designers use them and materials as connected to remote landscapes elsewhere.

Continual anthropogenic and non-anthropogenic flows of materials and energy constitute the processes of urbanization and landscape change. Designers participate in this reorganization of materials, much of it bound temporarily in urban parks, buildings, and infrastructure. While materials are selected for ecological, structural, and aesthetic properties applied to a particular designed site, their production is linked to an unknown network of distant forests, quarries, and factories elsewhere. Through specification, designers inadvertently transform remote landscapes, concealed and abstracted through the commodification of natural resources. Examining material dynamics enables a direct confrontation with the uneven, socio-

ecological dynamics of globalized urbanization under advanced capitalism. While these so-called 'externalities' are typically considered outside of a designer's scope, how might their examination inflect, interrogate, and stimulate new ways of designing?

This seminar expands the consideration of materials in design beyond a single-state, incorporating multi-scalar, socio-metabolic lenses to better grasp the scope of material practice for design. We will examine theories and metrics associated with material practice, including urban metabolism, materialism, material trajectories, and labor relations, through spatial and temporal frameworks. Student research projects will parallel course themes through an in-depth study of a single material stream. Structured as a collaborative research workshop, the course is driven by reading discussions, lectures, primary and archival research, and speculative drawing.

COURSE STRUCTURE

The course is structured as a collaborative workshop in which student research projects parallel weekly themes and provide a range of examples through which to interrogate class topics. Each student team will examine a single material stream through the following three lenses:

Part I Material: Properties and Performance is a detailed look at materials and their properties in design, exploring their performance as well as how they become commodities through testing and standardization. We read texts that address the agency of material properties and examine the cultures of technology and design that produce construction materials. Each research team will examine a particular material's composition and select one of its desired properties to study.

Part II Material Geography: Landscapes of Exchange looks at materials as linkages between sites of production and consumption, examining the way in which these landscapes are related beyond the displacement of matter between them. This section involves a deep examination into the human and non-human forces that shape landscapes, and the political dimensions of unequal ecological exchange. Following the same material studied in Part 1, students will examine the material source landscape through archives, literature, and interviews, to complicate the deceptively simple lifecycle diagram. In this section we will read texts on the measurement of metabolic processes, tracing the commodity chain, and social resistance to forms of material production.

Part III Material Futures looks at changing socio-metabolic periods to contextualize material practice today and speculate about the future. Through the seminar projects, we will formulate questions about how these distant relationships might be integrated into design thinking. These three axes of investigation – of physical properties, networks, and time – draw together disparate fields (philosophy, construction, industrial ecology, for example), and the course will require an interest in moving between them. Class content is driven by reading discussion, lectures, and site and archival research.

OBJECTIVES

The primary course objective is to foster critical thinking about material practice in design today, acknowledging the environmental and social relations of contemporary material flows, and raising important questions about how to build in the future:

1. Students will initiate and conduct collaborative research projects about individual material streams. These projects will involve the synthesis of interdisciplinary sources, from architecture, landscape architecture, geography, ecology, political economy, and sociology, among others.
2. In Part I: Students will gain a brief introduction to construction material properties, their use within contemporary design practice, their marketing and regulation within the building industry, and their evaluation within green building indices.
3. In Part II: Students will investigate landscapes of extraction, analysing the environmental and social consequences and relations of material flows. Through historical analysis, students will examine metabolic and political economic contexts, making links between global material flows and local environmental change.

4. In Part III: Students will apply research developed in Parts I and II to pose critical questions about material practice for design today.

EVALUATION

Each student will be responsible for critical responses on four of the five weeks with required readings, leading up to two reading discussions (depending on class size), and a three-part research project. Reading responses are one-page, 500-750 word, critical engagements with one or more of the required readings, and *are due on the Course Learn Site by Sunday evenings*. The leading of a reading discussion involves presenting the structure and argument of a text and putting forth a set of questions that engage the class topic and provoke discussion. While the reading presentations can overlap with one of the reading responses, they require thorough preparation and referencing of the text. For each of the six weeks involving reading discussions, three or four students will present one text each – these discussions will run roughly one and a half hours. Research projects will be conducted in teams of two, and will involve written and drawn analysis of the three topic areas. Engaged participation is crucial; attendance at all sessions and arrival at 10 am are mandatory. If you must be absent for any reason, please notify the instructor in advance. Evaluation will be based on class participation (15%), reading responses (15%) and the presentations and submissions for Part I (20%), Part II Preview (10%), and Part II/III Final Presentation (40%).

SCHEDULE

WK	DATE	TOPIC	DUE / RESEARCH PROJECT
PART I MATERIAL: PROPERTIES AND PERFORMANCE			
1	SEP 12	Introduction I. Course Overview II. Research Project Overview II. Composition / Taxonomy	Submit material and partner choices by email, Sept. 15
2	SEP 19	Material Agency I. Reading Discussion II. Students: Slides III. Properties / Performance	Reading response (always due Sunday PM) Slide: Properties and Performance
3	SEP 26	Material Control I. Reading Discussion II. Regulation / Evaluation III. Case: Soil	Reading response
4	OCT 3	I. Part I Research Presentations II. Hand out Part II Assignment	Presentation (10 min)
PART II MATERIAL GEOGRAPHY: LANDSCAPES OF EXCHANGE			
	OCT 10	Thanksgiving – no class	
5	OCT 17	cancelled	
6	OCT 24	Material Exchange I. Reading Discussion II. Students: Slides III. Case: Stone	Slide: Landscape of Exchange Reading response
7	OCT 31	Material Flow vs. Locality I. Reading Discussion II. Models of Metabolism / Methodologies of Tracing III. Case: Steel	Reading response
8	NOV 7	Part II Research Previews	Presentation (10 min)
PART III MATERIAL FUTURES			

9	NOV 14	Demolition and Transport I. Trip to Materials Recycling facility (to be determined)	
10	NOV 21	Futures I. Reading Discussion II. Workshop Exercise III. Case: Wood	Reading response
11	NOV 28	Part II/III Research Presentations	Presentation (30 min)
12	DEC 5	Part II/III Research Presentations	Presentation (30 min)

REQUIRED READINGS will be available as PDFs on the Course Learn Site.

PART I MATERIAL: PROPERTIES AND PERFORMANCE

WK2: Material Agency

Jane Bennett, 2010, "The Force of Things", "The Agency of Assemblages", in *Vibrant Matter: A Political Ecology of Things,* (Durham: Duke University Press) pp. 1-38.

Manuel DeLanda, 2005-7, "Matter Matters – a series from Domus Magazine", published in *Domus Magazine* from n. 884 to 901.

[MINERAL] Jeffrey Schnapp, 2003. "Three Pieces of Asphalt", *Grey Room* 11, pp. 5-21.

Recommended

[METAL] Mimi Sheller. "Mobile Homes", in *Aluminum Dreams: The Making of Light Modernity,* (Boston: MIT Press, 2014), p. 115-144.

[MINERAL] Michael Welland, 2009. "Servant: Sand in Our Lives," in *Sand: The Never-Ending Story*, (University of California Press: Berkeley), pp. 234-271

[POLYMER] Roland Barthes, 1972, "Plastic," in *Mythologies,* (New York: Hill and Wang) pp. 97-99

WK3: Material Control

Vaclav Smil. "What Matters Most: Biomaterials, Construction, Metals, Plastics, Gases, Fertilizers, Electronics" in *Making the Modern World: Materials and Dematerialization.* (West Sussex: John Wiley & Sons, 2014). pp. 45-76.

[BIO-COMPOSITE] Shelia Kennedy and Christian Grunenberg. "Material Presence: Return of the Real." *KVA: Material Misuse.* 4 Vol. (London: Architectural Association, 2001) pp. 2-21.

[MINERAL] Seth Denizen and Etienne Turpin, 2012. "Stratophysical Approximations: A Conversation with Seth Denizen on the Urban Soils of the Anthropocene." CE No. 4 Issue on Material Shifts, pp. 31-45.

Recommended

Katie Lloyd Thomas, 2012. "'Of their Several Kinds': Forms of Clause in the Architectural Specification," *Architectural Research Quarterly,* Vol. 16, Issue 03, pp. 229-37.

PART II MATERIAL GEOGRAPHY: LANDSCAPES OF EXCHANGE

WK6: Material Exchange

Sabine Barles. 2014. "Urban Metabolism: Persistent Questions and Current Developments." *New Geographies*, 06. pp. 63-69.

[METALS] Stephen J. Bunker and Paul S. Ciccantell, "Matter, Space, Time, and Globalization," in *Globalization and the Race for Resources,* Baltimore: Johns Hopkins University Press, 2005, pp. 1-32.

Erik Swyngedouw, 2003."Metabolic Urbanization: the Making of Cyborg cities." in, Swyngedouw, Erik, Heynen, Nik, and Kaika, Maria (Eds), *The Nature of Cities: Urban Political Ecology and the Politics of Urban Metabolism*, (New York: Routledge), p. 21-40.

Recommended:

Elaine Hartwick. Towards a Geographical Politics of Consumption. *Environment and Planning A,* 22:1177-1192, 2000.

Abel Wolman, 1965, "The Metabolism of Cities", *Scientific American,* 213(3), pp. 178-190.

Peter Baccini, Paul Brunner, 2012. "Metabolic Phenomena in the Anthroposphere," *Metabolism of the Anthroposphere: Analysis, Evaluation, Design*. (Berlin: Springer-Verlag), p. 1-172

WK 7: Flow / Locality

[METAL] A. Laurie Palmer. "Openings," "Aluminum," "Iron," and "Lead", in *In the Aura of a Hole: Exploring Sites of Material Extraction.* (London: Black Dog Publishing, 2014), pp. 6-9, 30-35, 86-91, 121-129.

[BIO-COMPOSITE] Anna Lowenhaupt Tsing, 2005. "A History of Weediness", in *Friction: An Ethnography of Global Connection,* (Princeton: Princeton University Press), pp. 171-212

Jane Hutton, "Reciprocal Landscapes: Material Portraits in New York City and Elsewhere", *Journal of Landscape Architecture,* 2013.

Recommended:

[MINERAL] Lucy R. Lippard. *Undermining: A Wild Ride through Land Art, Politics, and Art in the Changing West,* (New York: The New Press, 2014), p. 1-72.

[BIO-COMPOSITE] Peter Dauvergne and Jane Lister, 2011. "The Global Political Economy of Timber," in *Timber* (Malden: Polity Press), p. 1-26.

PART III MATERIAL FUTURES

WK9: Transport / Demolition

Recommended: (these will not be discussed, don't do responses for these)

Pierre Belanger, 2007. "Landscapes of Disassembly," *Topos*, 60: 83–91

Keller Easterling, 2005. "Subtraction" in, *Enduring Innocence: Global architecture and its political masquerades*, (Cambridge: MIT Press) pp.160-183

WK10: Socio Metabolic Shifts

[METAL, BIO-COMPOSITE] Lewis Mumford. "Objectives" and "Chapter 2: Agents of Mechanization," in *Technics and Civilization*, (Chicago: University of Chicago Press, 1934), pp. 3-9, 60-106.

[BIO-COMPOSITE] Mary M. Berlik, David B. Kittredge, and David R. Foster. "The Illusion of Preservation: a Global Environmental Argument for the local Production of Natural Resources." *Journal of Biogeography*, 29, p. 1557-1568.

Vaclav Smil. "Material Outlook" in *Making the Modern World: Materials and Dematerialization.* (West Sussex: John Wiley & Sons, 2014). pp. 157-180.

Recommended:

Fridolin Krausmann, Marina Fischer-Kowalski, Heinz Schandl, and Nina Eisenmenger, 2008. "The Global Socio-Metabolic Transition: Past and Present Metabolic Profiles and their Future Trajectories," *Journal of Industrial Ecology,* 12(5/6): 637-656.

Paul H. Brunner, 2007. "Reshaping Urban Metabolism," *Journal of Industrial Ecology,* 12(2): 11-13.

REFERENCES (All available on Course Reserves at Musagetes Library)

Astrid Zimmerman, 2011. Constructing Landscape: Materials, Techniques, Structural Components. (Basel: Birkhauser).

Meg Calkins, 2009. “Ch.2, Background: Inputs, Outputs and Impacts of Construction Materials”, and “Ch.3: Evaluating the Environmental and Human Health Impacts of Materials,” in *Materials for Sustainable Sites: A Complete Guide to the Evaluation, Selection and Use of Sustainable Construction Materials*, (New Jersey: John Wiley & Sons,).

Bjorn Berge, 2009. *Ecology of Building Materials*, (Oxford: Elsevier).

John Fernandez, 2006. *Material Architecture: Emergent Materials for Innovative Buildings and Ecological Construction*, (Oxford: Elsevier).

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 1132, 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 and alternatives: Plagiarism detection software (Turnitin) will be used to screen assignments in this course. This is being done to verify that use of all material and sources in assignments is documented. In the first week of the term, details will be provided about the arrangements for the use of Turnitin and alternatives in this course.

Note: students must be given a reasonable option if they do not want to have their assignment screened by Turnitin. See Academic Integrity - Guidelines for Instructors for more information.