Architectural Drawing and Representation, ADR 2: ARCHA4024
Laura Kurgan – Course Director

Lectures in the Architectural Visualization since 1900:
Reinhold Martin
ADR2 Lectures and Tutorials:
Laura Kurgan, Danil Nagy, Katie Shima, Jason Vigneri-Beane –
TA's: Skylar Bisom-Rapp, Susan Bopp, Mondrian Hsieh, Chelsea Hyduk, Jordan Merdink, Bika Rebek, Lorenzo Villagi, Ray Wang

Monday 11am – 1pm, Wood Auditorium, History of Visualization.
Tuesday 10-noon, Wood Auditorium, ADR2 Lectures/Reviews, OR
Tuesday 1-3, Office Hours, Room: 300 Buel North(Kurgan) and 505 Avery(Vigneri Beane), 412 Avery(Nagy) Tuesday 7-9, Office Hours, Room 505 Avery(Katie Shima)

Introduction:

"If you want to understand what draws **things** together, then look at what **draws** things **together**." Bruno Latour.

Visualization tools and drawing have changed radically over the last century, in both the practice and pedagogy of architecture. The course charts these shifts, beginning with the presumption that there are strong links between old and new media, analogue and digital methods, drawing with pencils, and drawing with software.

Given the indispensible role of visualization in facilitating and communicating design ideas, this course will introduce students to, and address a range of questions about multiple techniques of architectural visualization. For example: how have techniques of visualization moved beyond the conventions of two-and-three-dimensional hand drawing, which have defined architectural production for generations? Are two and three-dimensional drawings too limited for the ways in computation has transformed architecture? Are fifty dimensions necessary for architectural visualization? How has the proliferation of technology had an effect on softwares, techniques, platforms, and methodologies of drawing? Whether designers develop a series of plans and sections, dictate the precision of a tectonic detail or toolpath, or compute the values necessary to design environmental systems, visualization is the crucial interface between designers, their clients, consultants, the diverse communities of architecture and its history.

The premise behind the Visual Studies Sequence at the GSAPP is that as methods of visualization, architecture and its production change, pedagogy must respond to these transformations. Rather than being driven by this imperative, however, this semester, we ask what the larger implications of visualization are for architecture, for contemporary visual culture, and for the move from modernity to postmodernity and beyond?

Lastly the course will also address how the audiences for viewing, and methods for distributing visualization has changed, not only through the network, but also politically and aesthetically. While each student/designer will address these topics in unique ways, taken together, they may suggest how new and emerging forms of visualization support integrated thinking at multiple scales, combining complex geometries, informational systems, geospatial data and parametric modeling. As such, the sharing of the work produced by students via blog and cloud media, as well as through the traditional reviews of work in situ, is critical to creating our own audience for the work produced in our class.

ADR2 is designed to integrate the GSAPP curriculum with reference to the History and Theory, Visual Studies and Core Studio 2. While the focus of the course is on the production, tools, and techniques of drawing, the intent of the course is to foster active engagement between the history and theory of visualization, the practice of drawing, and the design studio. The connections, although not always

Assignments 1 and 2:
There will be two assignments handed out over the course of this semester, which will loosely repeat with a range of media and content for visualization.

The first half of the semester is structured around the idea of an analogue drawing machine. Each student will build a machine -- using a constrained palette of materials, for example dowels, rubber bands, string and more -- make drawings with it. Then, each student will translate their tools into digital ones, iterate and reinterpret their analogue drawings in digital ones. The content for the drawings and the machinery for drawing them will be inspired by a range of assigned industrial global processes, for example an oil refinery, money, or corn farming.

Using Charles and Ray Eames film Powers of Ten, as an example of visualization of multiple scales of architectures, we will take into account that what they did in 1977, with multiple cameras, and simulations, even hand drawings, can now for the most part, be replicated on our computer desktops with multiple softwares. While their work is canonical, a lot has changed, and so their work must be reinterpreted. For example, the basis of the book is this according to Ray Eames, "Charles liked to quote Eliel Saarinen on the importance of always looking for the next larger thing and the next smaller. The idea of scale – and of what is appropriate at different scales, and the relationships of each to each – is very important to architects. In global cities today, I wonder what scales should be placed side by side in order to compare each to each – not necessarily one scale up and one scale down. Each student will choose three scales at which to draw their industrial process.

In the second half of the semester, we will apply precisely the same method to a section cut through each student's studio project. This time they will build a digital sectional machine and produce and animation which considers their building three scales of operation. Finally and then translate this into a set of constrained parameters in order to iterate their drawings and ideas.

You are advised to read three things specifically for ADR2 over the course of the semester:
Bruno Latour, "Drawing Things Together"
Paul Klee, <u>Pedagogical Sketchbook</u> with introduction by Sibyl Moholy-Nagy
Charles and Ray Eames, <u>Powers of Ten</u>

<u>Structure of the Course</u>

The first two hours of the course each week involve lectures on the history and theory of visualization in architecture since 1900. The second two hours will include introductory lectures that frame the drawing assignments, tutorials on methods and practice of drawings, and reviews of drawing assignments. We will emphasize the distinction between using techniques descriptively and generatively, and explore the opportunities that arise because of it. The assignments aim to make links between the lectures, drawing tutorials, and work in studio.

a. Monday 9-11 am: Lectures on the History of Visualization
b. Tuesday 10-noon Lectures/Tutorials/Drawing OR Tuesday 1-3pm Office hours with Instructors and TA's
d. Deskcrits with TA's
e. Tutorials will be placed on the website each week prior to class.
f. Occasional invited guest experts in visual methods, will give lecture/tutorials which will be videotaped by the GASPP Cloud Directors and inserted into a new archive of video tutorials which will begin an archive of methods of instruction in visual studies, analogue and digital.

Work:
Students are expected to each week:
1. To read assigned readings – download from Courseworks – ARCHA4024

to the class website each week. You are also expected to come to office hours, present your drawings and ask questions about the video tutorial.

3. To complete each part of two drawing assignments which are due over the course of the semester.

4. Talk to your TA about your work, once a week.

5. Complete assignments for ARCHA4326, specific to ADR2 (ARCHA4024).

6. Attend scheduled reviews.

Your Grade will be determined by:
Attendance in class 10%
Completion of assignments: 50%
Completion assignments in History of Architectural Visualization: 40%

Assignment 0 - “Drawing things together”

Keywords:

- Process
- System
- Structure
- Scale

infrastructure -- territories, landscapes, buildings, precise machinery, molecular structures, and temporal sequences. They are data-rich and politically polarizing. These processes will be the site of your drawings for the first half of this course, at a range of scales.

Choose one from the following list of industrial processes:

- corn farming
- cotton milling
- money
- oil refining
- sand processing
- rare earth metal production

Using “Powers of Ten” as your model, select a primary scale at which your process needs the most interrogation: consider the transformations that have resulted in its configuration at this scale, and what are the relationships between the inputs and outputs of the process? What role does time play? What are the systems -- notational, coordination, technical and physical -- which describe it as a process? Then consider your process at two other scales - Powers of X larger, and Powers of X smaller. Ask the same questions of these two other scales as that of your primary scale.

Deliverable: For office hours, bring in 9 images of and a few sentences about your chosen process; these could be photographs or diagrams, 3 for each scale of interrogation. Begin to formulate a thesis that you can develop into a series of drawings in the next phase of the assignment.

Hand out 1/21

Due 1/28

Assignment 1a - The Drawing Machine

Hand out 1/21: Due 2/4

Keywords:

- Section
- Mechanics
- Actuators
- Input/Output

mathematics, and nowadays proliferate as computer scripts. We use algorithms as problem-solving tools, to create results that would otherwise be difficult or impossible to know. The harmonograph, for example, adds up the movements of two or more pendulums, enabling the documentation of how the pendulums move through space as well as the precise drawing of ellipses, spirals, and other types of curves.

Invent a drawing machine, paying particular attention to the relationship between its inputs and outputs. Aim for your outputs to go beyond the predictable, to design a system that reveals something unconventional for a spatially motivated, which is to say, architectural drawing. Construct your drawing machine using up to 5 of the following materials:

- dowels
- string
- rubber
- wire
- plastic bags
- clamps
- t-square
- compass
- motors
- weights

Consider the medium the machine will deploy, the motions or gestures it will use, the manner in which it is activated, the quality of the marks it makes, the resulting composition, etc. All of these choices influence the reading of the resulting drawing, so use them deliberately to articulate your intent. The effect of the finished drawing should help the viewer understand how you intend it to be read, such that a viewer could begin to understand what the drawing is about without a verbal explanation. Use this assignment to explore visual/graphic ideas that you can develop in the coming assignments. Your machine is not required to mimic or reflect the machinery or processes involved in the topic you have chosen (oil refining, cotton processing, etc.). It should rather interpret the ways in our topic will have an influence on the design of your machine and the ways it can inform your drawings.

Deliverables:

One drawing, 18" x 18", as well as annotated photographs or video documentation of the machine

Assignment 1b - The Exploratory Section

Hand out 1/28
1st pass due 2/04
Final version due 2/11

Keywords:

- Control
- Association
- Data
- Multi-Dimensionality

The topic you chose in the Assignment 0 involves vast networks of physical infrastructure, spatial products of all sizes -- territories, landscapes, buildings, precise machinery, computer chips, molecular structures, and temporal sequences -- scales of matter ranging from the geological to the atomic.

Using “Powers of Ten” as your model, select a primary scale at which to cut a section through your process: consider the configuration of your section at that scale. The sections must be cut through physical matter, whether a geographical feature, an industrial building, a piece of machinery, an atom, etc. Then cut two more sections and consider your process at two other scales - Powers of X larger, and Powers of X smaller. Ask the same questions of these two other scales as that of your primary scale - cutting through physical matter at multiple scales.

Use the three sections to reveal what cannot be seen by looking only at the surface of things, showing both the spatial relationships as well as the narrative, temporal dimensions, or in-depth implications of the topic. The sections must be accurate and legible, but they must also articulate an effect, and a set of notations appropriate to the topic, as explored through your machine drawing.

Consider the critical data and quantifiable elements available in your topic that you can continue to develop in coming assignments, which will add more dimensions to your drawings beyond the common four: x,y,z axes, and time. Given the outputs of your machine, which can be described as units or systems of measure, or as dimensions, consider what sort of coordinate system you will need to construct your sections. Make a tool to help you annotate your drawing with a coordinate system to help you measure and give dimensions to your drawing; make a parallel rule for a cartesian coordinate system, or a ruled compass for a polar system, or another device of your choosing. Use this in combination with traditional drafting tools - adjustable triangles, rulers, french curves, templates (these could be made with a laser cutter). All marks must be made by hand. Consider your hand's role in the process; exploit the effects that can be achieved by hand but that are not possible or not efficient with computation.

Deliverables: Produce three hand-drafted drawings, 18" x 18". Document your coordinate system tool through photographs.

Assignment 1c - The Digital Assembly

Handout: 2/18
Pinups: 2/25 and 3/04
Review: 3/11

keywords:

- Flow
- Parameter
- Assembly
- Metrics

Parametric design tools are excellent platforms not just for exploring the formal possibilities of your

Begin the assignment by considering your three previous sections as a single system. Mine your drawings for specific strategies in representing the various dimensions and scales within your process. Also consider the specific inputs, processing, and outputs present in your drawings. Then create a digital assembly within Grasshopper that can capture all of these strategies and start to link the various dimensions and scales.

Think conceptually about how to translate each element of the system from an analogue to a digital one, or from a drawing to a computational form. How are the inputs entered into the visual software environment and what kinds of data structures do they take? What are the digital corollaries to the measuring, dimensioning, and drawing tools you created in the previous assignment, and how can they be captured within the node-based workflow of Grasshopper? What are the resulting outputs, marks, traces that produce the final drawing?

The result of this assignment will be a Grasshopper definition as well as a single drawing that captures at least three specific input states of your digital assembly. These input states should be a reworking or further development of the Powers of X explored in the previous assignments. As the visual output of the digital assembly, this drawing should explore the multi-scalar relationships of various dimensions within your process, include the four standard dimensions (three spatial dimensions plus time) as well as other dimensions present in your system (for instance political, social, material, costs, quantities, carbon footprint).

Deliverables: Produce one grasshopper definition and a resulting drawing, 18”x18”.

Glossary of Terms: Please edit yourselves to make the terms relevant to architecture:

actuator: a mechanical device for moving or controlling something. (Merriam-Webster)

agent: something that produces or is capable of producing an effect; a means or instrument by which a guiding intelligence produces a result (Merriam-Webster)

algorithm: Procedure that produces the answer to a question or the solution to a problem in a finite number of steps. (Merriam-Webster)

analog: of, or relating to, or being a mechanism in which data is represented by continuously variable physical quantities (Merriam-Webster)

assembly: the fitting together of manufactured parts into a complete machine, structure, or unit of a machine (Merriam-Webster)

behavior: the way in which something functions or operates (Merriam-Webster)

cartesian coordinate system: a coordinate system that specifies each point uniquely in a plane by a pair of numerical coordinates, which are the signed distances from the point to two fixed perpendicular constraint: the state of being checked, restricted, or compelled to avoid or perform some action (Merriam-Webster)

coordinate system: arrangement of reference lines or curves used to identify the location of points in space (Concise Encyclopedia)

data: factual information (as measurements or statistics) used as a basis for reasoning, discussion, or calculation; information output by a sensing device or organ that includes both useful and irrelevant or redundant information and must be processed to be meaningful; information in numerical form that can be digitally transmitted or processed (Merriam-Webster)

digital: of, relating to, or using calculation by numerical methods or by discrete units; of, relating to, or being data in the form of especially binary digits (Merriam-Webster)

dimension

drawing: the art or technique of representing an object or outlining a figure, plan, or sketch by means of lines (Merriam-Webster)

driver: a mechanical piece for imparting motion to another piece; a piece of computer software that controls input and output operations (Merriam-Webster)

dynamics: a branch of mechanics that deals with forces and their relation primarily to the motion but sometimes also to the equilibrium of bodies; a pattern or process of change, growth or activity (Merriam-Webster)

effect: a change that results when something is done or happens; an event, condition, or state of affairs that is produced by a cause; a particular feeling or mood created by something (Merriam-Webster)

expression: a mathematical or logical symbol or a meaningful combination of symbols; a mode, means, or use of significant representation or symbolism (Merriam-Webster)

input: a component of production (as land, labor, or raw materials); information fed into a data processing system or computer (Merriam-Webster)

iteration: a procedure in which repetition of sequence of operations yields results successively closer to a desired result (Merriam-Webster)

generative: having the power or function of generating, originating, producing, or reproducing (Merriam-Webster)

kinematics: a branch of dynamics that deals with aspects of motion apart from considerations of mass and force (Merriam-Webster)

machine: a constructed thing whether material or immaterial; an assemblage of parts that transmit forces, motion, and energy to one another in a predetermined manner (Merriam-Webster)

mechanics: a branch of physical science that deals with energy and forces and their effect on bodies (Merriam-Webster)

metric: a standard of measurement, especially as applied to a system of value.

nesting: to form a hierarchy, series, or sequence of with each member, element, or set contained in or containing the next <nested subroutines> (Merriam-Webster)

output: something produced: as mineral, agricultural, or industrial production; the information produced by a computer (Merriam-Webster) process

polar coordinate system: a two-dimensional coordinate system in which each point on a plane is determined by a distance from a fixed point and an angle from a fixed direction (Wikipedia)

reading: the act of reading; material read or for reading; extent of material read; a particular version; data indicated by an instrument; a particular interpretation of something (as a law); a particular performance of something (as a musical work) (Merriam-Webster)

recursion: a determination of a succession of elements (as numbers or functions) by operation on one or more preceding elements according to a rule or formula involving a finite number of steps (Merriam-Webster)

scale: a proportion between two sets of dimensions; a distinctive relative size, extent, or degree; something graduated especially when used as a measure or rule (Merriam-Webster)

simulation: the imitative representation of the functioning of one system or process by means of the functioning of another (Merriam-Webster)

spline: a thin wood or metal strip used in building construction; a function that is defined on an interval, is used to approximate a given function, and is composed of pieces of simple functions defined on subintervals and joined at their endpoints with a suitable degree of smoothness (Merriam-Webster)

structure:

system: a regularly interacting or interdependent group of items forming a unified whole; a group of devices or artificial objects or an organization forming a network especially for distributing something or serving a common purpose (Merriam-Webster)

trajectory: the curve that a body (as a planet or comet in its orbit or a rocket) describes in space (Merriam-Webster)

variable: a quantity that that may assume any one of a set of values (Merriam-Webster)