Cybersyn Control Room,
Santiago, Chile, 1973.

Architecture Machine
Group, *SEEK*, 1970.

Andrew Atwood, Sara Constantino, Gabriel Fries-Briggs, Anna Neimark, Nicholas Pajerski, M. Casey Rehm, Jose Sanchez, Brendan Shea & Emmett Zeifman
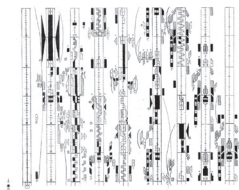
A Brief Symposium on Automation in Architecture

Public conversation held at 2426 SET in Los Angeles, 15 April 2017.

Images in the lower right corner were produced by a passive observation machine built by Reimaging, which documented and rendered the event in real time.
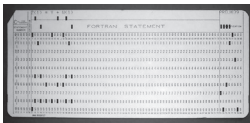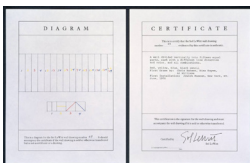
Fortran code punchcard, 1950s.

Rudolf Laban, Labanotation, 1929.

John Cage, *Concert for Piano and Orchestra*, 1957-58.

Sol Lewitt, *Wall Drawing 49*, 1970.

Emmett Zeifman

This is our brief seminar on automation. Automation as a technological fact and a way to think about how to make things. Some of the questions we're confronting now are rooted in a specific period in technology, art, and architecture, and in the parallels that emerge between them. A strange confluence of computational technology and conceptual art practice—which seems to particularly resonate around 1969—is a way of framing things. Authorship and control—constructing methods of authoring or de-authoring your practice and/or controlling or losing control of the things you make—is a general topic. There are people you wouldn't invite to this, because for them there is no problem of being an author, you just try to be brilliant and creative, as opposed to having to construct problems of authorship in your work, which all of us around this table are interested in.

As a personal aside, one motivation in organizing this is witnessing at an institutional level, at SCI-Arc [where I taught from 2014-17], a separation between projects that look to conceptual art as a means of questioning authorship and ones that question authorship by foregrounding computational technology and the facilities at SCI-Arc such as the Robot Lab. On the surface they appear to be quite different, but they are engaged with similar underlying questions. To bridge that divide at the level of institutional appearances seems important.

Sara Constantino

I'm not an architect. I've worked with machine learning as a model for how organisms function and have taken how organisms function as a way to adapt machine learning and reinforcement learning algorithms. I've seen technologies adopted—and developed—through various art and architecture practices in ways that differ from how I use them and how the fields I work in think of them. In my work, we rarely consider the aesthetic outcomes of these technologies, and we take a different critical approach to them. I'm interested in the ways that other disciplines take up scientific terms and technologies through analogy and as material. Seeing them played out in these ways makes different aspects visible and highlights both their structure and malleability.

We've come up with a set of terms that form a framework for organizing some of these thoughts, but these are by no means fixed or exhaustive. Hopefully, through conversation, these terms will evolve or change. I'll set the stage for today by presenting this framework, contrasting historical examples related to computer science with loose analogies in contemporaneous art practices.

The first is notation and instruction. A necessary condition for the separation of author and output is the ability to translate and communicate information, which requires its formalization and abstraction. In the broadest sense, this happens when you translate thought into language. Programming is finding a sequence of instructions that will automate the performance of a specific task. This can take the form of a written set of instructions—the first algorithm intended to be executed by a computer was written by Ada Lovelace in the mid-1800s—but it can also take the form of digital algorithms. This is Fortran code, a general purpose programming language developed in the 1950s that is still in use today. The following images show examples of notation, abstraction, and formalization of other types of systems. Rudolf Laban developed Labanotation in 1928 as a script for motion. It was used to optimize movement in factories, and, later, to train robots to understand and replicate human movements. In *Concert for Piano and Orchestra*, 1957, John Cage severs the link between notation and communication and in doing so reveals what's necessary for abstraction to communicate directly. Cage's notation separates author from output with an interpretive layer.

Emmett Zeifman

These things that we talk about in a technological sense are meant to optimize, say, the capacity to translate information; whereas in other disciplines they might take on the opposite ambition of introducing indeterminacy or chance into the operation.

Sara Constantino

Sol LeWitt's *Wall Drawings* are instructions of different permutations and combinations of lines that make up a final piece. He writes the instructions and someone else executes them. His authorship is deferred through notation.

Another category is interaction and feedback. There are two kinds of control. Open-loop control requires an external output, for instance, a thermostat. It gets too hot, you adjust the thermostat, it's still too hot, you adjust it again. Closed-loop control includes a feedback mechanism: a thermostat that can sense the temperature in a room and self-adjust. The study of closed loop systems is the study of cybernetics. Early cyberneticist Ross Ashby likened cybernetics, the abstraction of systems, to geometry, the abstraction of physical space. Cybernetics extended into many fields: organizational cybernetics, socio-cybernetics, economics. Project Cybersyn is an example of an attempt at a self regulating economic feedback system implemented into the Chilean government in the 1970s. A machine senses information about resources and, if any measures fall out of a certain bound, alerts workers, who adjust production. An important part of cybernetics is self-regulation—feedback which is used to optimize the system.

In *SEEK*, or *Blockworld*, an installation in a 1970 exhibition called *Software*, gerbils played with a set-up of blocks. As they knocked the blocks over, a robot would try to understand what the gerbils wanted and reconfigure the blocks.
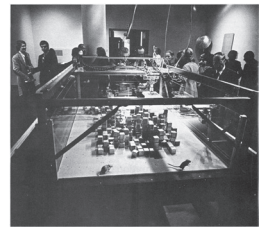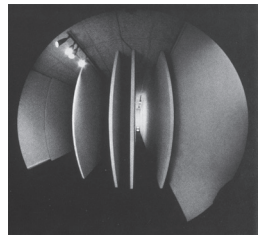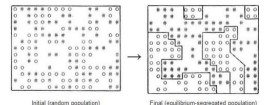

Bruce Nauman, *Corridor*, 1970.

Lynda Benglis, *Now*, 1973.

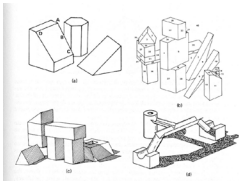Thomas Schelling, Dynamic Models of Segregation, 1971.
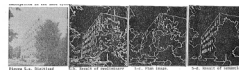
Marcel Duchamp, *Three Standard Stoppages*, 1913-14.

ontologist, *I Am Sitting in a Video Room*, 2010.

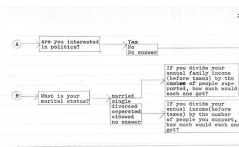Robert Smithson, *Asphalt Rundown*, 1969.

Adolfo Guzman-Arenas, Computer Recognition of an Object in Three-Dimensional Space, 1968.

Takeo Kanade, Computer Vision, 1978.

Gerhard Richter, *Woman with Umbrella*, 1964.

Emmett Zeifman

It was by the Architecture Machine Group, which became the Media Lab. *Software* brought together work like this with conceptual artists like Hans Haacke and Vito Acconci. The curator Jack Burnham understood software not to be a description of a specific technology, but rather an idea of systems of exchange—as opposed to the stuff being exchanged, which he described as hardware.

Sara Constantino

A lot of cybernetics deals with achieving optimal equilibria through feedback mechanisms. And then you have systems where there is no a priori optimal and it's unclear where the feedback will lead—for example, with the robots and the gerbils. In Bruce Nauman's *Corridor*, a camera films you from behind as you walk towards a screen. The screen shows the footage of you walking, and you then react to your own image as you walk. Another example is Lynda Benglis responding to a video of herself reading. She tries to match her voice to what she's previously recorded, producing a feedback that is out of sync, full of gaps and missteps.

Agent-based models and multi-agent systems are related to cybernetics. In ABMs, the focus has been mostly on complex systems and the properties that emerge from the repetition of very simple processes. You start with simple agents, governed by simple rules, and complex dynamics evolve. In Thomas Schelling's Dynamic Model of Segregation, giving individual agents just a slight preference for being around similar others and letting them sort over time produces highly segregated neighborhoods.

Our next category is entropy and chance. Both cybernetics and computer programming draw heavily on information theory, which was developed by Claude Shannon in the 1940s to explain the relationship between signal and noise in telecommunications. A key measure in information theory is entropy, which quantifies the uncertainty involved in the outcome of a process. Something that will happen for sure, with probability one, has zero entropy, while something that will happen with equal probability, a coin flip, has maximal entropy. This is related to the second law of thermodynamics, where entropy is a measure of disorder in a system. The explicit formalization of randomness and chance are extended into the behavior of materials in order to loosen form and play with natural states of dissipation.

Emmett Zeifman

Everyone probably knows the *Three Standard Stoppages*. Marcel Duchamp drops a one-meter rope from a height of one meter and traces the contour as a new standard.

Sara Constantino

This is a recording of "I Am Sitting in a Room" by Alvin Lucier, 1969 again. He records himself reciting a text in a room, records the recording played back into the room, and continues doing this until all you hear is the resonant frequency of the room. It's a loosely entropic process that reveals something otherwise not visible.

Emmett Zeifman

The recording stops when the speech dissipates into pure tone. Whichever room he plays it in, he'll play it a different number of times until it hits that point. There is a great contemporary take on it, uploading and downloading the same YouTube video to reveal the degradation of a digital file.

Sara Constantino

More directly-related to entropy as physical states of disorder is Robert Smithson's, *Asphalt Rundown*, 1969, where he pours a dump truck of asphalt into a quarry in Rome. Nancy Holt called it "entropy made visible."

The last of our four categories deals with pattern recognition. This is the problem of how to interpret and extract meaningful information from data. It's related to machine-learning, which has been used for classifying objects, faces, emotions, or whatever, in data. And especially to computer vision, which is the study of how artificial systems can be trained to understand images or extract information that can then interface with other actions or decisions. At issue is what gets lost in the translation between different media or human and computer or different processes in the computer. Gerhard Richter's *Woman with Umbrella*, 1964, is one of his photo-paintings, which take the raw data of snapshots and translate them into painting.

Emmett Zeifman

Photography itself is an automatic process that captures indiscriminately whatever is in the frame, and then it is up to the photographer, or in this case the painter, to give form to that.

Sara Constantino

Like a computer, which doesn't by default associate any value to pixels within an image. Criteria of evaluation have to be trained. Another example here, more related to the collection and analysis of data, is Hans Haacke's *Visitors' Profile*, which was an interactive piece that compiled statistics from visitors to a museum. Visitors would fill out questionnaires and the results would be displayed the next day.

Emmett Zeifman

This version is from the *Software* exhibition. In 1971, Haacke was able to make the collection and display of the statistics happen live, which was the original intention.

Sara Constantino

Those are the terms and related analogies that we thought might offer a productive framework for the rest of the discussion.
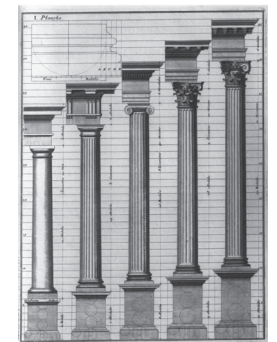
Emmett Zeifman

A recurring problem in thinking about the relationship between architecture and art is that things that are
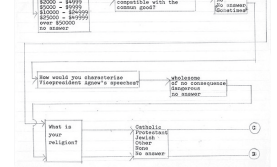
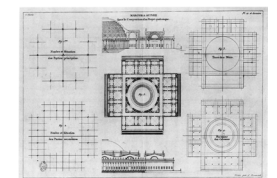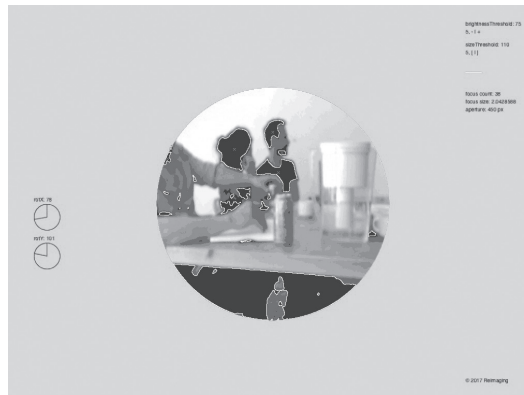Hans Haacke, *Visitors' Profile*, 1970.

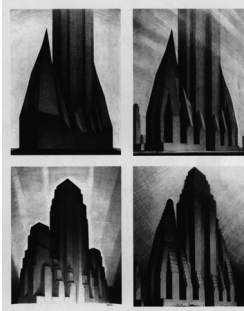Leon Battista Alberti, *Ten Books of Building*, 1452.

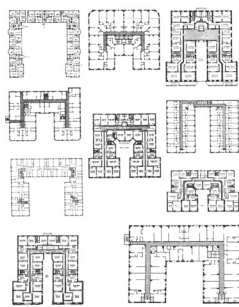Claude Perrault, *Ordinance for the Five Kinds of Columns*, 1708.

Jean-Nicolas-Louis Durand, *Precis des leçons d'architecture données à l'École Polytechnique*, 1825.
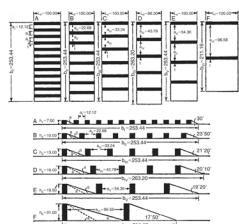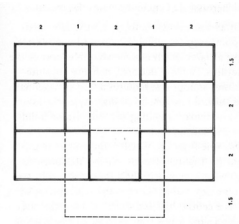
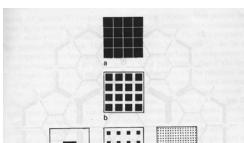Hugh Ferriss, 1916 New York City Zoning Ordinance Drawings, 1922.

Steven Holl, *Alphabetical City*, 1980.

Walter Gropius, Shade Study, 1931.

Colin Rowe, "Mathematics of the Ideal Villa," 1947.

problematized in conceptual art practices are given in architecture. Producing work as notation is the only thing we know how to do.

I'm going to give a short prehistory of architectural automation, again using examples that stop in the late 1960s, early 1970s, at which point computers come into play. Everyone else probably knows better the contemporary state of things than we do when it comes to architectural technology. If the roots of the discipline are in the split between the architect who gives instructions and the builder who carries out those instructions, as in Alberti's formulation of architecture, there are the origins of what we understand to be a contemporary author problem in architecture. Related to this is the study of proportions and relationships through mathematical and geometric processes that begins in the Renaissance. The examples in Alberti's treatise are described through formulas, rather than drawings, to ensure faithful communication of his examples, as his text was initially disseminated through manuscript. Later, Claude Perrault's ambition to strictly systematize and notate the proportional relationships of the columns makes them repeatable, but also one can imagine, thinking forward, parametric—codification and the systematization of relationships are a presupposition of automation. Durand's reduction of architecture to an orthogonal grid, which can then be manifest in any number of permutations and combinations, is a high point of this project, and relates also to the problem of pedagogy and the possibility of standardizing and disseminating architectural forms. This particular image, borrowed from Antoine Picon, gives instructions for moving from the abstraction of the grid to the fully fleshed-out plan within a single sheet, the architectural analog to Sol LeWitt's instructions. With industrial urbanization, the technological, economic, and regulatory determinism of architecture can also be understood as a form of automation. Building codes, economic systems, technologies of construction condition to a high degree what's possible. For Rem Koolhaas, looking back at Hugh Ferriss' drawings, there is the idea that the city authors form automatically, outside the control of the individual author. Or take Steven Holl's *Alphabetical City*, which finds repeating patterns in the anonymous architecture of the city, as produced by real estate speculation, zoning laws and the need to access to light and air. That zoning is played out with more explicit authorship in the urban projects of modernism, as with Walter Gropius trying to systematize the distribution of building mass to ensure optimal sunlight and ventilation.

There is an interesting moment at Cambridge in the 1960s in this twinned history of architectural authorship, which is shaped by both internal disciplinary constraints and external constraints. Colin Rowe is there. Leslie Martin and Lionel March are experimenting with optimal urban forms: architecture as autonomous formal structures—say the nine square grid that persists from Palladio to Le Corbusier—or architecture that is produced by defining contextual variables and constraints. You have Peter Eisenman's *The Formal Basis of Modern Architecture* and Christopher Alexander's *Notes on the Synthesis of Form*, which became a foundational work in thinking through how to understand and abstract complex systems. Both formalize and notate architectural form,

but they generate separate trajectories, which play themselves out for instance in two urbanisms of the late 1970s. Eisenman's Cannaregio is completely indifferent to anything but its own disciplinary context and internal rules—architecture authored from within. Andres Duany and Elizabeth Plater-Zyberk's plan for Seaside is manifest in the urban code, which serves as a mechanism for constraining the production of urban form and ensuring it meets a standard of livability and desirability in the image of a vernacular American townscape—architecture authored from without.

This is all to say there is a constellation of things—architecture, conceptual art practice, and actual computational technologies— which put on the table related ideas and questions of authorship and control. We are interested in what can come from analogies and translations between these things, and our intuition is that the practices we've invited to participate in this discussion—Andrew Atwood and Anna Neimark of First Office, Gabriel Fries-Briggs, Nicholas Pajerski and Brendan Shea of Reimaging, who are also hosting us here at 2426 Set, M. Casey Rehm of Kinch, and Jose Sanchez of Plethora Project— each in their own way draw on these histories as a way of developing working methods and investigating how architecture might engage our contemporary social and technological circumstances, in which automation is pervasive.

As a provocation, our four categories—notation and instruction [First Office], feedback and interactivity [Plethora Project], the entropic effects of feedback systems and the behavior of materials over time [Reimaging], organizing and making sense of data [Kinch]—might map onto these four practices, though we wouldn't want to pigeonhole anyone.

Presentations

Andrew Atwood

You sent us some readings, and I thought I would click on the first link, "Will Robots Steal Your Job," by Farhad Manjoo [*Slate*, 30 September 2011]. He says two things, which introduce a way to think about the problem of automation as it relates to architects. The first— in this article he's talking about scientists—is, "in most scientific fields there is a clear division of labor between humans and computers: machines occupy themselves with grunt work, they do the calculating, graphing, mixing, filing, watching or waiting. Wherever there is work that is too boring for a human you will find a robot ready to help." In the subsequent sentence he says about science, "here, people do everything that's remotely interesting." He goes on to explain that now computers can actually do some of the thinking. He paints a picture of a world where humans are reaching the limits of their cognition and speculates that machines will replace humans in thinking, which is to say that machines will start to do the interesting stuff. The implication is the inevitability of a role reversal; machines will be on top and humans will be relegated to the stuff that's not interesting. To me, that's an interesting provocation, although the reality is that a world where we are doing only boring things is also horrific. But automation might provide an opportunity to
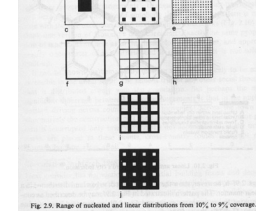
Leslie Martin and Lionel March, *Urban Space and Urban Structure*, 1965.
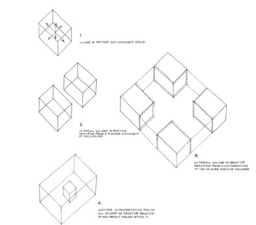
Peter Eisenman, *The Formal Basis of Modern Architecture*, 1963.
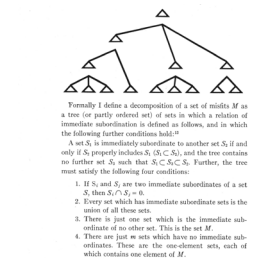
Christopher Alexander, *Notes on the Synthesis of Form*, 1964.

Peter Eisenman, Cannaregio Town Square, Venice, 1978.

ATWOOD, CONSTANTINO, FRIES-BRIGGS, NEIMARK, REHM, PAJERSKI, SANCHEZ, SHEA & ZEIFMAN

Andres Duany and Elizabeth Plater-Zyberk, Zoning Code of the Town of Seaside, Florida, 1982.

Farhad Manjoo, "Will Robots Steal Your Job," 2011.

Email from Anna Neimark to Andrew Atwood, 2017, 14 April 2017, with attachment: Sylvia Lavin, "Double or Northing: Architecture Not in Evidence," 2016, featuring Ed Ruscha, *Some Los Angeles Apartments*, 1965, *Beverly Glen*, 1965.
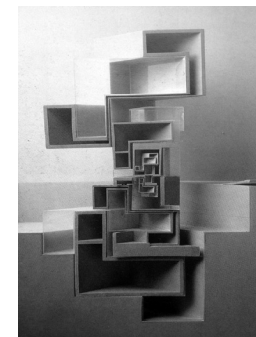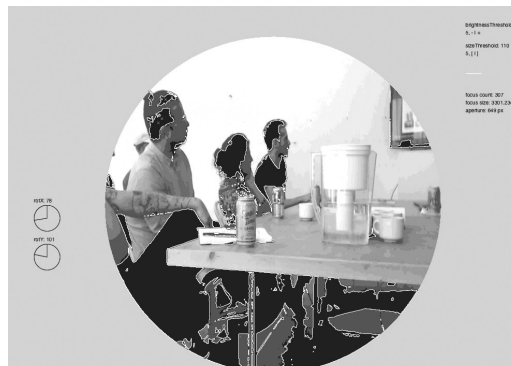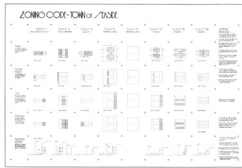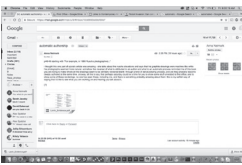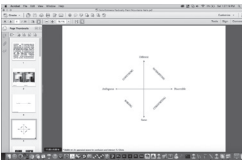

Andrew Atwood, Diagram, 2017.

think about what architects would do when forced to give attention to uninteresting things and types of work.

'Interest' has been defined as a spontaneous or, in the words of Richard Lind, automatic focus. So while Manjoo posits interest as something deliberate, thoughtful and willful, it's actually the most automatic of responses. You might say that "interesting stuff" is precisely what tools of automation might be best suited for.

I had this idea and then Anna sent me an email yesterday at 2:26 P.M. In it she links a Sylvia Lavin article ["Double or Nothing: Architecture Not in Evidence"] from the most recent issue of *Perspecta* [49 (2016)] and points me to page forty-eight or forty-nine and directs me to read something that starts with, "For example, in 1965 Ruscha photographed…," so this is a type of automatic authorship: "In 1965, Rucha photographed some apartments in Los Angeles and put them together in a book called *Some Los Angeles Apartments*. The buildings are identified only by street address and the photographs themselves are prosaic and perfunctory in their generic frontality, indifferent print quality and what has been called amateur framing. That same year Ruscha selected ten of these photographs and drew them with soft spreading graphite, carefully expunging antennae and sharpening color contrasts to intensify their apparently automatic manufacture." I'd parallel this with the prospect of humans doing the not interesting work.

This is a working diagram from my book of alternatives to interest as the primary mode of working on or paying attention to architecture. It defines the interesting as different and discernible. Same and ambiguous things are boring, and same and discernible things are comforting, which is the category of normal, everyday, vernacular. Different and ambiguous is confusing. If robots are going to do the interesting work for us, which is typically the place in which we find architecture, we have to stake out a territory in the nether regions. I'll just very quickly show these drawings that I'm doing. They are basically operating in an automatic way towards blankness and indifference, in Michael Meredith's words, towards what I would describe as boring or comforting or confusing projects.

Emmett Zeifman

Do you have a script that produces the drawings?

Andrew Atwood

I have a script, his name is Alex. He uses scripts to make them, but he's someone who sits in my office.

Anna Neimark

I sent that email to Andrew suggesting that we not show our work, and so what I did was open a lecture that Andrew and I gave recently and deleted all the slides from it that had First Office work. This was an automatic process. You'll see in the next five slides a dialogue with some of the things that Sara and Emmett mentioned. I want to start with Simondon, because here we see the process of concretization. The object of automation goes through what he describes as an almost

biological transformation. Then the link to autonomy, and Eisenman's process of concretization again. And then the link to authority. With Labrouste it is coming out of the school of the Beaux-Arts but also resisting authority, because he goes to Paestum, not to Rome, and all of the things that follow. Within the drawing we can talk about certain kinds of techniques and the projection of shadow and orthographic projection, etc., that interest us as work that can be scripted. We can also then talk about authorship and the birth and death of the author, all of these things that point to self and the search for authorship in found objects or readymades and how they begin to emerge in the work that we do. Finally, it's coming back to Smithson, in Wales, in a famous photograph by Nancy Holt, back to 1969. With Andrew's introduction of working with things that are boring, and automating those processes, it seems that we're constantly coming back to the question of the author, the question of the self, and a prehistoric structure that defines all of those concerns.

Nicholas Pajerski

We are Reimaging. We are going to do this in three parts, the first being feedback and entropy. We'll show one piece of our work and supplement it with material that has been helpful for us. This project shows an interface from the perspective of robot number one, which was controlling a collaborative fabrication platform that had an open loop to it that allowed for improvisation. A running theme is working through notation systems that allow for humans to jump into these processes. This is breaking the wall of the Automat, which celebrates the human behind the machine. If you were to take the machine as a holistic thing it would be magical, but when the wall is broken, it's humorous. On the topic of entropy, when Gordon Matta-Clark deep-fries a photograph it reveals another process, based on the ink or emulsion on the photograph. That process of translation is an opportunity to jump in.

Gabriel Fries-Briggs

We called this section "mixed signals." Partly in relation to mixed mediums because this is an overlay of what could be called drawing—we still haven't found the right words for it—and physical model. There's a relationship to mixed-media, but what we've been trying to figure out is how to turn those things into signals, so that we don't have to talk about mixed-media, or post-medium specificity. Signals are much more portable than mediums. We're able to rudely overlay things without paying attention to our predecessors. This relates to the aesthetics of, if not automation, then art processes. I look to Cedric Price's Generator Project for multiple reasons, one of which would be an early collapse of a building and a computer into an awkward space where they become almost indistinguishable in drawing, but also a way of combining two things, like a drawing and a model, or a building and computer, as a way to stage a confrontation, rather than optimize performance. Some of the things we do with computation might be dysfunctional or useless, or hopefully confrontational. There are endless ways
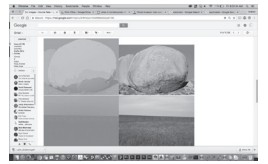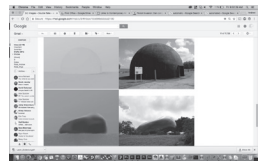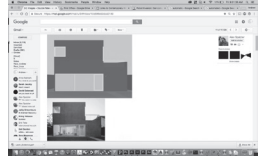
Andrew Atwood, rendered drawings and source photos, 2017.

Gilbert Simondon, from *On the Mode of Existence of Technical Objects*, 1980.

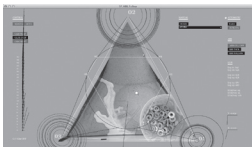Peter Eisenman, from "Aspects of Modernism: Maison Do-mino and the Self-Referential Sign," 1979.
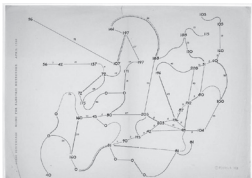
Henri Labrouste, Temple at Paestum, 1829.

Marcel Duchamp, Door, 11 rue Larrey, 1927.

Nancy Holt, Robert Smithson at Pentre Ifan, Wales, 1969.

Reimaging, *Interface Capture 07*, 2015.

Toshi Ichiyangi, *IBM for Merce Cunningham*, 1960.

Pierre Charlot at an Automat, 1969.

of encoding architecture so that it can be worked on serially. We are interested in seriality and in trying to share systems with some of our peers, rather than always creating our own syntax. We have as many syntaxes or systems as we have buildings, and it's hard to talk to each other. Around the theme of mixed signals, people in this room share an interest in creating instruments to produce signals. We're interested in things that are portable, like the hygrometer, which might fit in a backpack or hand and accompany one on a journey. Putting an interactive display or putting a sensor in the back of a car—again like Ruscha—or putting a sensor in this room.

Brendan Shea

This section is about noise, but it also deals with distribution and transportation. We're interested in noise as a compositional strategy but also an experience—the built environment is noisy. As a subset of entropy, we'll talk about the noise or distortion that comes from signalization. This is a path where we're looking at the noise of the city, thinking about a route between institutions and, instead of optimizing that route, finding a logic for producing a longer path that might be a noisier experience. We take data sets from the city that position reservoirs and produce a series of turning radii that take you through these reservoirs to get from one point to another instead of taking the shortest possible route. Here you see the tracking of a mosquito based on different conditions in the environment that start to influence the behavior of species. Another thing that we're interested in is displacing authorship in ways where other modes or actors influence representation; here, we do this with a device that creates a relationship between automatic image production and animal behavior. At a larger scale, these processes start to behave almost automatically and give us a way to start thinking about things that are much bigger than architecture, like landscape and infrastructure, and a reciprocity between things that seem to sit outside of architecture's control.

M. Casey Rehm

Automation is central to my work, and the capitalist bearings of these techniques on the profession are always lingering in my mind. Henri Maillardet's *The Draughtsman* is a mechanical machine that translates a simple percept—the winding up of a spring coil—to a series of cogs and gears, which attempt to take that motion and expand it into a more intricate or highly ordered output. It's forced amplification through a simple mechanical process. All of these techniques are operating in that sense, as a way of amplifying myself as a designer. Most of the algorithms I work with don't learn or adapt, they have very prescribed behaviors governed by rules specifying how they understand their environment and infect it, largely because I find these sorts of algorithms more interesting. Unlike those that do optimize or adapt, these algorithms are specific intelligences that I've designed to look at an image or data set in an attempt to find new forms of composition or new understandings of aesthetics that take into account human and non-human users.

I'm utilizing intelligent agents to search for things that I can't find. Beyond amplifying my output, or serializing production, which is an

aspect of what I'm doing, I'm also trying to uncover relationships or design spaces that I can't see. This is why I almost exclusively used, until very recently, non-learning algorithms that follow bottom up relationships. They're seeking a local adequacy and, in this case, pixel to pixel relationships, rather than any kind of holistic understanding. I think adequacy is more interesting for architecture than optimization, and in most cases is more critical—as the intensities and complexities increase, you need affirmation that everything is going to work. There are 1,008,000,000 pixels in this image that I did with Marcelo Spina of P-A-T-T-E-R-N-S. We took drone photographs of Budapest with a series of P-A-T-T-E-R-N-S projects for the city composited into them and manipulated variations of open-source machine vision algorithms like OpenCP to do absurd things to the images. Shadows were generated by having pixels play prisoner's dilemma with each other—one of our interns discovered a prisoner's dilemma algorithm and ran it and said those look like shadows. There's an agnosticism about what's valuable, and a looseness.

That has carried over to work in the Robot House [at SCI-Arc], where we're codifying proto-architectural material behaviors. This autonomously 3D-printed object was created by the robots with a small nylon extruder, using cameras and point-cloud scanners to identify the material that's already laid out. In this case there are two behaviors, one which marks the territory through striated orthogonal lines that never intersect, and another which ties them all together through a network of diagonals that produces a structural diagram.

The installation I did last summer in the SCI-Arc Gallery was fully designed in a black box algorithm, from plan layout to the material positioning on the mirrors. An understanding of the scales of tools—how big is an airgun, how easy would it be to nail these joints together—and structural performance was embedded into the algorithm but so were absurd things, like the form being generated by an understanding of color theory in an image that's no longer part of the project. I have top-down control over all of these things. There's nothing happening in the script that I don't understand. While I may not be able to project where everything is going to be, I know exactly why it's there. It means that as a designer you have to understand all of the problems that you want the algorithm to solve, which as an architect is a dubious proposition. You could make the argument that architects are not actually good at executing architecture, because it's an incredibly complex problem, and that's why you build in contingencies, from the material down to the lifecycle of the building.

This is a project on hoax urbanism where I'm working with deep learning algorithms, some of which are better at classifying regions of an image where a city may exist and others that are better at taking nonsense and creating order out of it, which is what begins to produce city-like structures within the ice rifts of the photographs of Mars. I understand the model of the algorithm and what I've trained it on—although I've been interested in allowing the machine to find its own training materials—but I haven't told the algorithm what a city is, or what to look for in a city. I put in a bunch of cities and it decided what the constraints of the city were
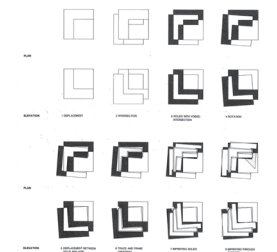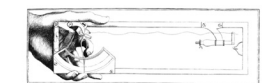

Gordon Matta-Clark, *Photo Fry*, 1969.

Reimaging, *Rubber Trusswork Overlay*, 2015.
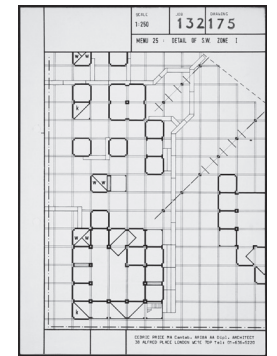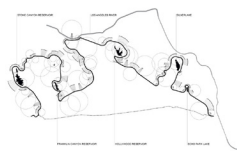

Cedric Price, Generator Project, 1978.
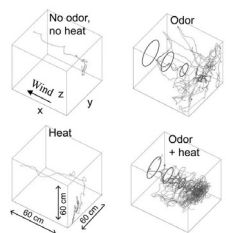

Peter Eisenman, Guardiola House, 1988.

Horace-Bénédict de Saussure, *Engraving of a Hygrometer*, 1783.

M. Casey Rehm with P-A-T-T-E-R-N-S, *Oblicuo*, 2015.

M. Casey Rehm, Autonomous 3D Printing, 2016.

M. Casey Rehm, *Control*, 2016.

M. Casey Rehm, *Life on Mars*, 2017.

Neil Gershenfeld and Jonathan Ward, Patent for Hierarchical Functional Digital Materials, 2012.
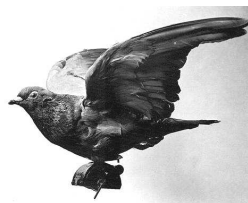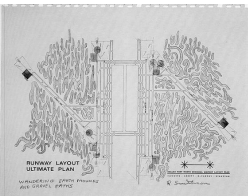
Reimaging, *Slow Paths UCLA to A+D*, 2017.

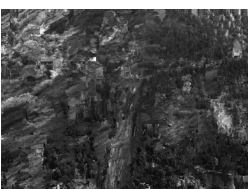Jeroen Spitzen, 3D Analysis of Flight Behaviour of Malaria Mosquitoes, 2013.

Remote Sensing Pigeon with Camera.

Robert Smithson, Dallas-Fort Worth Regional Airport Layout Plan, 1966.

Henri Maillardet, *The Draughtsman*, 1826.

and what was most important in terms of how to represent them. Up to this point, I think that the question of authorship is absurd, the machines do exactly what I tell them to. But at this point, there is more of a dialogue, the space is too complex for me to navigate, or perhaps the algorithm actually defines the problems about how to order complex sets, which is maybe what Andrew would say is the interesting part of architecture, defining problems.

Jose Sanchez

I'm perhaps the person here who still believes in a humanist approach. I have a similar background to Casey, where there was a fascination with artificial intelligence and agency—encoding design intent to create algorithmic architecture. That was very interesting and a fun time, but I got disenchanted at some point with my capacity to introduce noise into the system or introduce human agency halfway through. When I would press play in a script there would be no way to further interact. I'm sure there are ways of integrating that feedback, but I was interested in a much more interactive feedback between humans and automated instructions, much more like a video game. That was the point of departure for Plethora Project.

There is a fundamental project that has to do with discretization; these are the units from a patent of Neil Gershenfeld from MIT and Jonathan Ward, one of his students. We've never had digital architecture, or digital matter, all construction is still analog, and this is a small system of building blocks that create, similar to how Shannon described information theory, a signal, or matter that would actually be digital. There would be no analog noise. Instead of an extrusion of a 3D-printer, you would deposit small discrete blocks, there would always be a discrete finite state. I think it's particularly important to advance architecture towards discretization. Philippe Morel, who I taught with at the AA, has addressed these notions of elementarism, for instance with the Computational Chair. The Universal House envisions a universality of space and construction. Casey and others have put a lot of energy into an agenda for the discrete; there's a series of trajectories that are still to be developed as a reaction to the digital architecture of the 1990s.

One of my first projects that developed using these ideas was the *Bloom* project with Alisa Andrasek in London. It was reconsidering serial repetition. If anything was preached by the digital architecture of the nineties it was that you didn't want repetition or serialized components in order to differentiate form—*Animate Form* [Greg Lynn (New York: Princeton, 1999)] and so on. All of these parts are exactly the same, but they're flexible and have asymmetries that allow them to be recombined in different ways. This material was introduced into a social system, one that is highly volatile and unpredictable, to see how that could create a negative entropy. The project was an interactive building toy that would be formed by people at the 2012 Olympics. That set up the agenda for the work of my practice.

Discrete combinatorics suggests that we have very cheap components, almost free, and the value comes from the information that arranges those pieces together, as opposed to creating a whole, and breaking it down into parts in the way that we usually deal with

architecture. These are some of the things we do with students, studies of how simple units would describe a series of possible aggregations. I have taken that project and explored different aspects. This is *Block'hood*, video game urbanism. It discretizes the city, provides a catalog of over 200 blocks at this point, and puts it into the hands of a massive social system. Value emerges continuously or collaboratively, systems and loops between the community create order out of random series of instructions. The system doesn't have properties that would allow you to optimize it because there are competing criteria. You would never be able to run an algorithm to find a solution; rather, it brings to the foreground the idiosyncrasies of the communities that are playing it. It's a project of communication—a vehicle like a video game could be used to encapsulate knowledge and provide an infrastructure that would allow communities to resist automation as a tool of a neoliberal agenda.

I find myself agreeing with many Accelerationists. We need to use technology to advance towards a post-capitalist future, going through capitalism and developing technologies that engage explicitly with these problems. But I'm very skeptical that automation will yield value even if it is created for communities. I've seen projects that are starting to do that, like the Wikihouse, but I'm not thrilled. How do you start encapsulating knowledge into matter itself? How do you engage a community with open source technology and collaborate to develop such projects or even a new vernacular? Something like the Open Building Institute by Marcin Jakubowski has the right mindset but they're lacking architectural input. There's space to develop these ideas and provide alternative systems or trajectories to what automation is offering right now.

Discussion

M. Casey Rehm

Jose, Gilles Retsin, Daniel Köhler, and I have a lot of discussions about the discrete. My obsession with discrete parts has more to do with the discretization and ordering of data. I operate with a sense that all the information that I take into my systems has no significance. All of us are obsessed with the notion that architecture comes out an assemblage of insignificant or meaningless entities. There's not an overall form that gets hierarchically subdivided into its constituent parts. Daniel calls it, in German, the "open whole." I'm interested in systems that don't have a bound initially, which differs from the parametric model where you have to define the design space and the limits of the system within it. Although my work looks like it's continuous, because of how high resolution it is, it's made of discrete, fixed integers.

Andrew Atwood

I'm trying to reconcile a couple of things that Casey said. I can understand that as it relates the way in which parametric projects have been put in opposition to algorithmic projects—like ten years ago, when I did that stuff. With parametric projects, you apply a top down set of parameters and you play that out, looking down as God
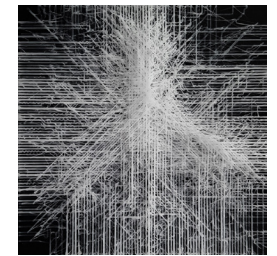
Alastair Parvin/Wikihouse,
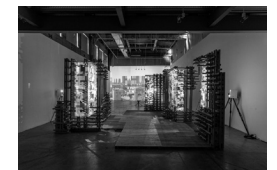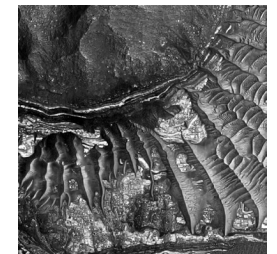MicroHouse, 2017.

Marcin Jakubowski/
Catarina Mota, Open
Building Institute.
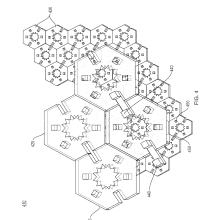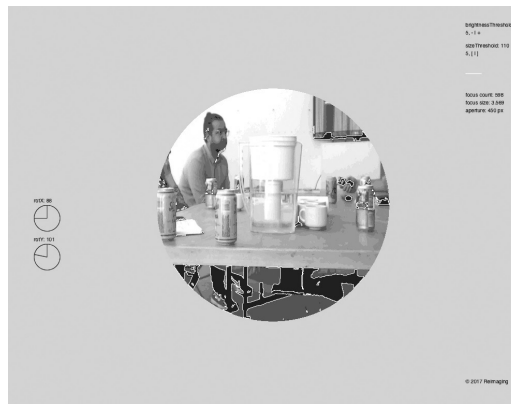
Philippe Morel/EZCT,
Computational Chair, 2004.
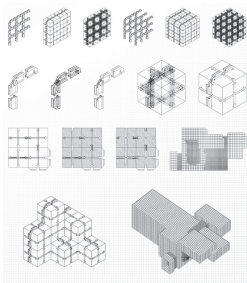
Philippe Morel/EZCT,
Universal House and
Assembly Element,
2009-11.

Alisa Andrasek and Jose
Sanchez, *Bloom*, 2013.

Jose Sanchez/Stratasys,
Polyomino - Chromonimo.

Jose Sanchez, *Polyomino II.*

Jose Sanchez, *Polyomino III.*

would. The algorithmic project would be the opposite. It's a bottom up project where you establish a set of local relationships that you allow to play themselves out and look for emergent properties—these are the terms from 2005… In your case, though, there were boundaries, which was interesting because it's related to the types of work we might be doing, which is to say you didn't know necessarily what it was going to do, but you had complete knowledge about what the system was. There is a knowledge boundary around things. You were not interested in exploring things you didn't know. There was nothing ambiguous about them, that you weren't in control of, in terms of your own ability to understand the process. That was surprising. I've always associated the algorithmic process with the degree to which one didn't understand exactly what was going on—the non-understanding was part of it. That's different than what [Reimaging] does. They don't care that they don't know. I don't think they have any real desire to know. You do.

M. Casey Rehm

Yes and no. The obsession with emergence is something that is different between say Roland [Snooks] and Alisa's generation and ours. The sense of the emergent in those projects was almost a theological devotion to something other happening within the algorithm, and also an obsession with pure abstraction and biomimicry, or complex natural systems that we could never understand. But they're actually straightforward. At Kokkugia, I knew how those things worked and so the surprise at the end was not interesting. The big break for us is that it's more about negotiation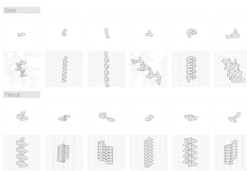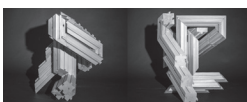, drift, relationships between entities. The fact that I treat a human user the same as a pixel user and that they're allowed to play together in the system. That kind of contamination of the system removes the reliance on a belief that there will be some emergent overall structure. Bottom-up becomes a strategy for defining, or growing, the design space, rather than a wonderful generative problem-solving tool.

Andrew Atwood

I have been wondering if what you're saying is the evolution of that problem which I understood. I would say it introduces an honest sensibility towards things.

M. Casey Rehm

It's not representational, or abstract. I think that's a big difference. I'm always trying to diminish the amount of abstraction. All the things I make are making that thing, they're not representing some other thing. The downside is that limits your ability to engage with those people outside of the narrow field that are looking at what you're doing.

Jose Sanchez

Also, you can become virtuoso at developing and playing with any kind of instrument. You don't need to understand the inner workings of the thing, it could be as black box as you want, if you play enough, you start predicting and anticipating. I know what's going to happen, it's going to vary here or there, but there are no huge ruptures,

unless there is feedback from a radically unpredictable data set. The introduction of true uncertainty is something that, for the most part, doesn't have anything to do with the computer. You need to find it outside.

Gabriel Fries-Briggs

I'm curious about the term black box. If we're a practice that doesn't really understand some of the things we work with, and doesn't really care, I don't have a problem with that, but I wonder if there's a model of control and another model of just looking at the output of the black box. Do people in this room feel like they have to open the black box, or can they collect things, because there's part of a script or code that they would copy and paste, or maybe they send the intern something and it comes back and they don't really care how it happens.

Andrew Atwood

That's why what Casey said is so crazy. I'm making these things and the things they make, that's it. I'm not evaluating what they've made after they've made them.

M. Casey Rehm

No, I am.

Andrew Atwood

But how?

M. Casey Rehm

I look at them and say, "I don't like that, go back in."

Brendan Shea

I would say adequacy is a carefully calibrated term. If there are modes of evaluation outside of optimization and adequacy and further along that spectrum, failure or uselessness might be something that we engage with. Something that's usually left off the table is something we would start to work with. I think adequacy is fantastic in terms of shifting out of the problem of the parametric project, but there would be other ways to come from the bottom end of that spectrum and distance yourself even more from the top down.

M. Casey Rehm

Ultimately, though, all of our projects are fluctuating between top down and bottom up. I'm evaluating outputs and going in and manipulating behaviors, or with some of the more interactive platforms, I have the robots doing it in real time. The fetishization, by a previous generation, of expensive materials and advanced fabrication technology disallowed the advancement of a project further than cool renderings and a couple of pavilions.
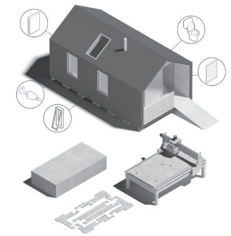
ATWOOD, CONSTANTINO, FRIES-BRIGGS, NEIMARK, REHM, PAJERSKI, SANCHEZ, SHEA & ZEIFMAN

CONVERSATIONS
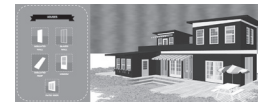
Jose Sanchez

You said, "amplify myself as the designer," and I instantly reacted to that. I find that's the very problem that we're facing. It seems to be the most common way that we're addressing the use of the computer. 99% of the stuff that comes out of the video game that I'm working on, or projects such as *Bloom*, is noise, it's random, and it's arguably irrelevant. I'm interested in that 1%. Those become their own spawning points, and this is where the social becomes important, because the tools and algorithms that we're working on are going to be used by the next corporate offices. Or they could become mechanisms to facilitate new forms of social production or vernacular architecture. How do you increase the imagination of a much larger set of participants?

Anna Neimark

Jose, wouldn't you want to be absorbed by the corporate entities, if you were interested in a social dimension? Why is there a distinction or an opposition? Wouldn't that be a way to make a difference in the world?

Jose Sanchez

I think that the organizational structure of most of those corporations does not allow them to become ethical enterprises. I would rather work on the infrastructures that allow people to organize themselves into new structures, as opposed to being absorbed by a corporation that is, inevitably, going to be biased to deal with forms of accumulation and would distort the project.

M. Casey Rehm

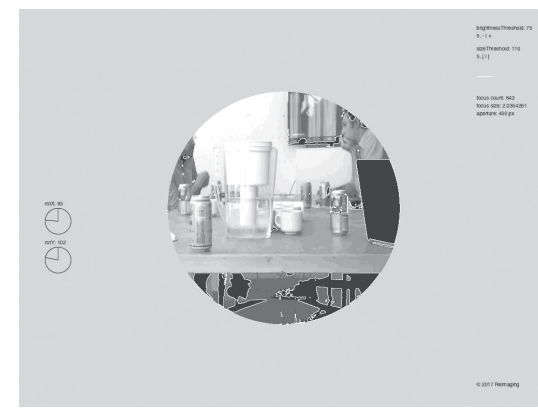With *Block'hood*, or Polyomino, on the one hand you're empowering a larger body of social participation in the design process, on the other hand, there's an intense consistency to the output that you insist on through the design of your platform. I think that's where our projects are similar, we're both obsessed with interface, whether it's interface between non-human users and data, for me, or human users and data, for you. It's a project on behavioural control. A corporate architecture office has—because of its structure—a different set of priorities. I believe there's a certain optimism to your project, there's a benefit to society. If it was a capital-driven project that a large firm like Gensler has to do, because of its overhead, it would be driven by a different ethic.

Andrew Atwood

I don't know if Anna's talking about just corporate architecture firms. Video game companies lean heavily on the accessibility of things that have already been established. Your video game is amazing in the way you can play it based on intuitions that have been established by a whole corporate structure that's in place. I can look at that game and understand it because I've played other games like it—it's a beautiful thing. This is the audience question. Accessibility works through some of the things you're doing, but it also relies on a whole set of assumptions that have been funded by—

Jose Sanchez

Do we have the tools within capitalism to dismantle it? Some would say no, it's naive to think that you would use the tools that are embedded in this structure. I think that as a longer term project there are steps to achieve an output that is more open. I think that the relation with an audience is something that needs to be produced over time, you cannot just jump into a more abstract video game, which will have a very niche, small community. A series of projects could start engaging with more complex ideas. But the failure, precisely, of a project like that one has to do with the predictability of the definition of the data set, the definition of the data structures, and the predictability of the outcome. That needs to be constantly challenged.

Anna Neimark

I think it's precisely with the tools of capitalism that we can destroy it. Don't we see it now with our current political system? I don't think we can come into a discipline with another set of tools and communicate within that system. I'm curious about self-combustion, because it comes back to automation as a conceptual project. I think it is with a conceptual project working through the background systems—I'm thinking of Kavior [Moon, in the audience], because you're working on Michael Asher—that you might be able to actually influence those systems.

Emmett Zeifman

Something we've talked about is that the processes which make it possible to automate—abstraction, formalization, notation—are the same as those that led art towards institutional critique, which is that one has to understand the system of exchange. The conceptual project of moving outside of traditional authorship leads to looking at systems and working through them to introduce a new perspective on the context you're working in.

Sara Constantino

Related to this and to the point Anna made, aren't those examples of one discipline entering another?. You were saying you can't take the language of another discipline and use that to deconstruct—

Joe Day [Audience]

What I think was said was, you can't take something from another discipline and use it to communicate. You can, however, take techniques from another discipline and diversify what's possible within your discipline. It may not speak that language, but I think—

Sara Constantino

But do you think at some point it becomes part of the language of the discipline it's brought into?

Joe Day

Absolutely. I came thinking this would get me away from the art and architecture discussion and towards
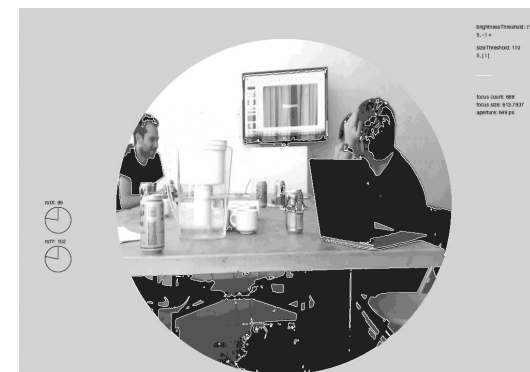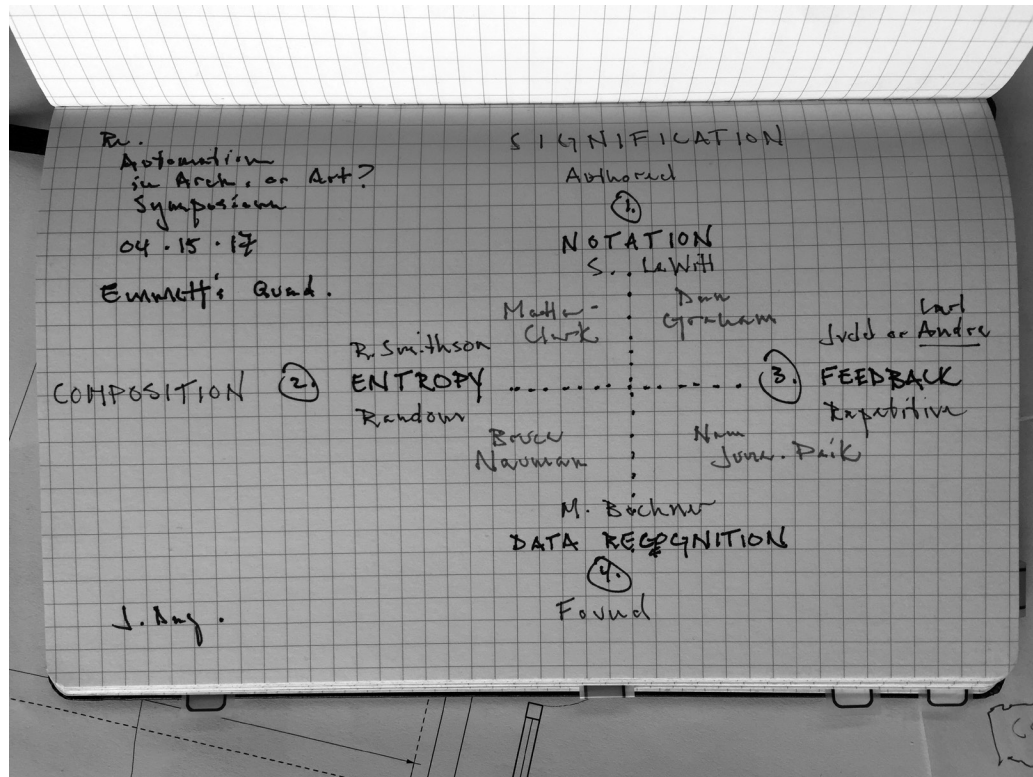
Joe Day, diagram, 15 April 2017.

the art and technology discussion, which I don't understand at all, but to the degree that it's in the art and architecture realm, I would challenge all of you, as I think the only person in the room actually alive in 1968—a lot of this went back to the sixties, but there is a generation echoing that one that might be a more useful model. I think your quadratic terms break into an axis of signification and an axis of composition. Anna and Andrew I associate closely with the axis of signification and Casey I think of as a leading avatar of new compositional strategies. I think they are different problems. I think the author axis in your four would be polarized by notation and data recognition, or the authored and the found, and the compositional axis would be between feedback and entropy, feedback being a play on repetition and its failure and entropy being the embrace of chance. I want to get past Smithson, in particular. Your polarities should be Smithson and entropy, Sol Lewitt and notation, Mel Bochner and data recognition, though that's not a perfect one, and Donal Judd and feedback, whose work is fundamentally about repetition and its failures, or its idiosyncrasies. But all of you fall more inside the quadrants, and artists in those quadrants that would get you closer to technology, because they were more fundamentally entrenched in technological ways of working, would be Matta-Clark between notation and entropy, Dan Graham, or perhaps Eva Hesse, between notation and feedback, Bruce Nauman between entropy and data recognition, and Nam June Paik between data recognition and feedback.

If there's a workable, useful analogy for what you are chasing, I think it would start in that generation.

M. Casey Rehm

When I was at Columbia, the joke was that the PhD students didn't realize anything happened after 1968. I was excited you notched it forward one year, but we could open it up a bit more.

Emmett Zeifman

It was a conscious decision to say we're not going to try to deal with a whole world of BIM and—

Sara Constantino

We purposely edited out anything after the 1970s.

Anna Neimark

We're pushing the brakes Joe, our generation.

Joe Day

It's funny that you feel that way. Because in that analogy of generations, the Smithson, Judd, LeWitt generation has already happened—they were the digital pioneers, for better or for worse…

Gabriel Fries-Briggs

So much of the conversation was around prehistory and even now we don't get past it. Whether something is automated or not matters as much now as it did ten years ago. Now, maybe the question is, whether you amplify your voice through automation or through selling your firm to a corporate architecture office—whether that actually matters as long as it's amplified in certain ways? Maybe the concern over prehistory and art references has to do with the lack of concern about whether something is actually automated.

Joe Day

I wonder how much automation and authorship really have to do with one another. Casey and Jose's presentations were the more compositionally inflected, and a similar anxiety was actually your precondition—multiple authorship or the ambition for a broader notion of authorship. Where the generation of new and differently variable assemblages is the task of the office, who has agency within that process becomes very important. For the other axis, the question is how much is or isn't automated, where you cleave to authorship and where you relinquish it, knowing that both are options.

Emmett Zeifman

To what extent is automation a more explicit conceptual problem in architecture, where so much is done for us, where there are so few choices to be made from the outset, given the intensity with which the forces of the world outside of architecture condition its possibilities—
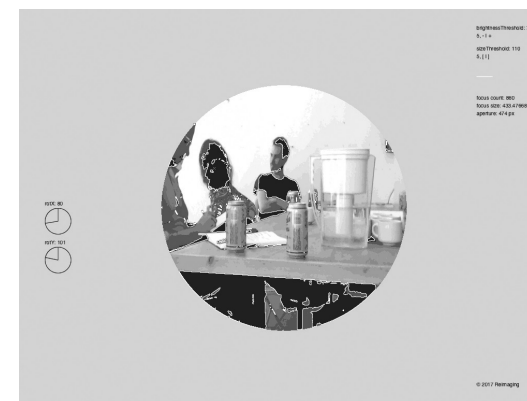
technically, economically, regulatorily, etc.—ignoring for now all the disciplinary constraints of what's appropriate at a given time?

Sara Constantino

I think the control over production is an economic or sociological problem more than a disciplinary problem.

Nicholas Pajerski

For us, it's actually more about the legibility of automation, giving yourself the opportunity to perceive that one out of the one hundred people did something crazy with the software, or that something was broken, and that you understood the system such that the moment of friction allows you to develop the project. In our work we've allowed for these moments of indeterminacy.

Emmett Zeifman

That's a traditional art model, where you're looking for the moments where something doesn't work smoothly, you turn the process back on itself to produce chance, error, randomness, the unexpected.

Nicholas Pajerski

I think precedents are much more contemporary, from the last six months, or two years. Discover Weekly on Spotify tells me the music I should listen to, Google gets me to the right place and Apple tells me how to spell because my preferences and tastes and patterns have been understood. They're not automated so much as they're intelligent. How do we see behind the scenes, render it visible? This is a representation problem.

Andrew Atwood

This problem of communication just isn't an issue for me. As Casey said, it isn't about representation, it just is the thing. Why do we need disciplinary jargon or conventions when you're just making the thing? Jose's point about taking something that is outside the discipline is that that is the condition that humans understand, the ease of a video game interface. So for me, the issues are not about communicating between architects. What sort of work are we going to do? How do we occupy our time? What will I do, as an architect? And what will you do, as a plumber? The problems don't rely on these arbitrary boundaries being placed around art, architecture, technology as disciplines, or bodies of knowledge, they're much more universal.

Sara Constantino

The automation that is worrying on a sociological or economic level has an economic ideology built into it, in the sense that these are optimized systems. Machine learning is often used to optimize clicks online, there are certain aims for human behaviour. It seems it's used very differently in architecture.

M. Casey Rehm

I look at this stuff from the professional point of view: how this transforms the office, how this transforms the profession, which then also transforms the cultural project. What happens to the cultural project of architecture, its ability to innovate, when the quantity of elites diminishes rapidly? That's why Jose's project is interesting. It's trying to address that fundamental problem that when the quantity of people participating in the profession drops off, the number of intelligences contributing to the discipline also diminishes.

Jose Sanchez

This is going to happen to every discipline. A few people will be on the side of creating the platforms or adding the criteria that will influence the way AI algorithms define value for a larger community. What will the rest do?

M. Casey Rehm

Does it matter if we stop advancing architecture? If fully automated luxury communism happens and we can just hang out as the machines design our buildings for us, and they're the same buildings for the next 100,000 years?

Emmett Zeifman

At that point you can choose to design a building if you want to, it's no longer labor.

M. Casey Rehm

It's a hobby, which is where architecture started. It was a hobby for aristocrats.

Emmett Zeifman

And it's never fully stopped being that.

M. Casey Rehm

The things that need to be represented are the biases in the system. Intelligent forms of automation are embedded in our culture and everything that we do. People, entities, corporations are developing those things with their inherent biases, with their agendas. Is it important for people that are playing Jose's game to understand that Jose has ambitions for their design work?

Jose Sanchez

The biases in those algorithms are mainly centered on the mechanisms of funding and the organization of the institutions that are creating them. The discipline needs to expose those biases.

M. Casey Rehm

There's an issue of resolution. First Office, Jose, Reimaging, and I all share similar techniques. I read Duchamp's
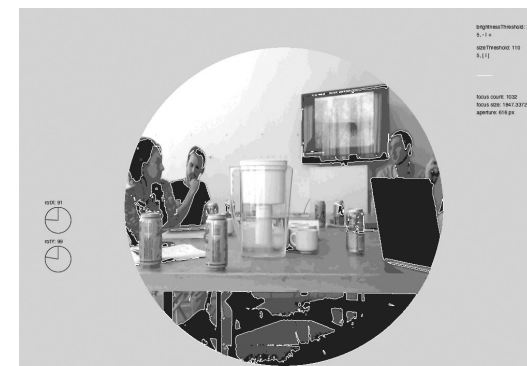
Shotgun [by First Office] as a structural project about utilizing a known architectural type to create dynamism in form. It has rule sets that constrain potential spaces by whether something is opened or closed. You're designing the interface for whoever might create the variation within the project. That's all that my work is doing, it's just that I do it with a billion really dumb things, and you are doing it with four really smart things, and Jose's doing it with 10,000 pretty smart things. All of our projects are dealing with interface and constraining the way that a system can be operated, so they're all embedded with our biases. But I think quantity becomes a conceptual problem. At one point, Wes Jones did a game studio at Harvard and was saying Jose's project is similar. He designed an architectural game and twenty people played it. How many *Block'hoods* have you sold?

Jose Sanchez

Forty thousand.

M. Casey Rehm

It's a vastly different project because it gets into the territory of big data, big information, and the system is so complex that you can't map it.

Jose Sanchez

The finite set needs to be open-ended, like what *Minecraft* did to open up the engine itself, where the system adapts over time. That's the challenge. How do you build the tools that break the system from within, or enable it to maintain a much more volatile state of equilibrium? It might completely disintegrate, or take on a life of its own.

Ben Borden [Audience]

Is there any value in preserving mysticism around using a black box? You don't understand how the box works, but then you build an understanding of how it works contrary to how the person who designed it thinks about it. Is that another way to break the system or to hack it?`

M. Casey Rehm

Is there value in preserving mysticism?

Ben Borden

Your critique of biomimicry and emergent designs implied a ghost in the machine, something magical.

M. Casey Rehm

The behaviors of the things participating were so abstract, there was purity to the fact that these things would get together. They're super simple and would produce the most abstract order you could get. Our generation of algorithmic designers is more corrupt about things outside the computer because computation is a material process and there's a finite amount of energy that you can consume for running computational processes. Even if Rule 110 can generate all possible architectures, eventually you run out of stars in the universe to power

it, there's a practical absurdity. We were taking something that was ideal and abstract and it would become skin decoration, or ornament. It didn't engage any problems outside of its own internal machination. It's very clearly in the Eisenman lineage and I think the stuff we saw today is more the Christopher Alexander trajectory.

Nicholas Pajerski

I think there is value in mysticism. It's easier to sell you a financial package that will continually reinvest itself because it learns your behaviours and it learns how the market behaves, and you don't have to do anything because it magically makes a bunch of money, then to sell you something that beats you over the head to tell you all of the ways it's learning your interests.

Sara Constantino

We don't know quite how or why deep learning algorithms do what they do. Maybe that's okay for certain disciplines or certain types of projects and maybe it's not okay when they are used to drive cars or make sensitive financial or legal decisions.

M. Casey Rehm

We're at a state, because of the acceleration of deep learning algorithms and cloud computing and distributed computing networks, where that's unavoidable. You just don't know how that stuff works. The new Google Translate just made its own language. They don't know why but it's better for translating. It's not a question of whether there is value there, it's—how happy are you to give over to the black box?
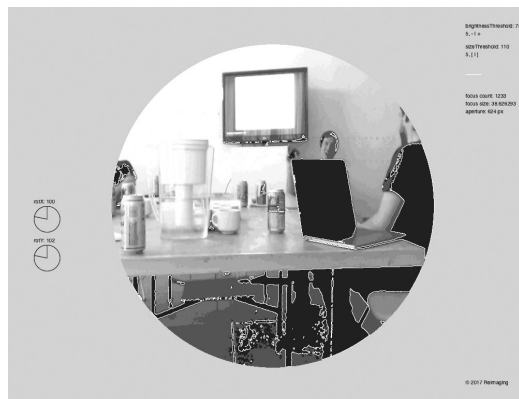
Sara Constantino

Attempts to visualize what happens in the deep learning black box look like your cities on Mars. Deep Dream is an attempt to visualize it without properly understanding what happens.

M. Casey Rehm

Which is actually where I started. Fundamentally it turns designing these machines from designing something that looks at stuff and decides what it is to designing things that could potentially make things, which is another conceptual, cultural shift.

Gabriel Fries-Briggs

The farther it gets from a person designing something to be fully automated, the more it gets towards the exact absurdities that we find so interesting. Why do machines immediately make Trump and Muppets? Because that's what they think we want. There's fear in every discipline about the disconnection between what we want and what the machine might want. There are strange things happening with adaptive automation where the machines that you might be using to run something in the background will revert back to your control temporarily, so that we keep a check on what the machines are doing. This is

more common in aviation, so that pilots don't fall asleep, than it is in architecture, maybe.

Sara Constantino

Like the Air France flight, when autopilot returned control to the pilots, who then crashed the plane.

Emmett Zeifman

Or, if all of a sudden you had to calculate how to Boolean one thing out of another and you don't know that descriptive geometry.

Gabriel Fries-Briggs

It's too late, you should have built in this adaptive automation fifty years ago.

M. Casey Rehm

The first autonomous traders were stupid but fast algorithms that did momentum trading. They had to regulate them because they would just drive the stock market into the ground.

Gabriel Fries-Briggs

Those things that seem to be at the forefront of automation, across disciplines, like adaptive automation, are actually most concerning because rather than checking in with a human to make sure things are running okay, or that we still have expertise, they're actually making sure we're still doing what the machine wants us to do.

Joe Day

Mysticism and command both sell perennially, I think both of those are possibilities and for some of you command is a more obvious point of departure and perhaps in other cases mysticism. Defamiliarization was a preoccupation in the twentieth century and I think it will persist in the twenty-first.

Aubrey Bauer [Audience]

I see a distinction between the uses of a critical project in the room. You have control over what it is you're producing in this local context, and my question is about the implications at the global level, where we are talking about capitalism, and corporations, and the way that our data-driven lives are already so autonomous from us. We are very present here as authors, but it doesn't sound like there's an author out there in the larger context. What are the uses of being authors and investigating these tools?

Emmett Zeifman

One question in framing the conversation was, to what extent do these very deliberate disciplinary acts and the specific aesthetics of those serve as a way to reveal something about the way the world works. Is there a way in which the conscious breaking of tools, or inventing of tools, or deployment of tools towards non-optimal or

unfamiliar ends produces some sense of where we are, allows us to read something?

Aubrey Bauer

But at the point where these things are autonomous, is that project paradoxical, is it futile?

Brooke Hair [Audience]

I agree, I don't know that once automation is set in motion, when it leaves the realm of the concept, that authorship matters at all. Authorship seems like a hangover from art discourse, which ultimately functions so that the work can be commodified. I don't think the author is important so much as the owner. It's a question of who controls the apparatus, and the user, who is subject to behavioural control in a way that can be unconscious in that you don't even realize that this is what structures your social and interior reality. We need to bring the institution into the discussion. I don't know that authorship is really significant.

Sara Constantino

I think authorship is a stand in for ownership. Authorship might not be the right term in this broader sense.

Brooke Hair

We make things, and we want to claim agency in that way, but the social landscape is more complicated, because it actually depends on who has control over what is designed and how it's designed.

M. Casey Rehm

I think authorship is still important, because most of the things that are controlling our lives right now, these large scale programs, do have authors, and they do have inherent biases in how they're built. Within most of the neural network and deep learning work right now, AI are still being targeted at tasks. A long as there's a determination of task, definition of model, and focusing of these algorithms, authorship is still critical.

Aubrey Bauer

The question of authorship changes when the scale changes. The size of this kind of critical project produces certain effects and certain interpretations, but when you scale that up, to the size of a corporation like Spotify, it becomes a totally different kind of conversation, because the autonomy of the program has overwhelmed the author. There is always a question of legibility and how much potential these projects have to be scaled up.

Jose Sanchez

More than authorship, I think that we should move towards tracing the origin. We're using authorship as a mechanism for branding, but at the same time we should
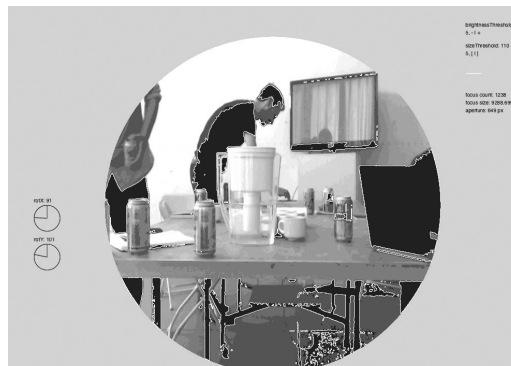
be able to trace back a system of authors and sources. Where's the information, the value, coming from? Ted Nelson talks about how the internet originally had two-way links, you would always be able to trace back to the origin where information was coming from, it was much easier than an internet that links only forward—links take you somewhere, but you can't really trace back. And that's happening with AI. We're building these databases, but who cares where they're coming from.

Sara Constantino

A lot of companies that formerly had proprietary algorithms, proprietary code, have now moved towards more open-source software, because they get data, which helps train their algorithms.

Emmett Zeifman

But also there is blockchain, where I can see the entire history of a transaction.

Jose Sanchez

Right, the whole ledger is there. But there is a saying that every open source project has a dictator behind it, because you need someone to advocate for enough time for the project to actually catch on—like Linus Torvalds and the Linux project. There seems to be inevitable authorship even in collective enterprises. I'm not so interested in diminishing authorship, because I find it inevitable, but in reinforcing the idea of origin, and the references. We quote texts in papers, we should be able to trace back where different ideas came from and with code that's not possible yet, but we're starting to get to the point where we have a much more referential system of knowledge. Ted Nelson's Xanadu project seems to be pointing to those ideas.

Nicholas Pajerski

You can't end on authorship, because at big companies like Spotify, they don't care. The people who work on things, they have an organizational structure by which they have incentives to produce.

Andrew Atwood

The different ways in which I think about authorship always refer back to, how I am going to occupy my time? Whether we're going to be allowed to do the interesting stuff, which is to say the things that we want to do, or are we going to be forced into a place where we don't know what we're supposed to do. I think the control and ownership question is interesting but, again, if I think about that, it is that someone else will be dictating to me how I actually spend my time. A lot of this stuff is contrived as a way to just give us something to do and we invent jargon and conventions simply so we can communicate and aren't confused.

Emmett Zeifman

We're also, for the most part, already in positions where we invent things to occupy our time.

Andrew Atwood

I did it from 9:00 A.M. today until I had to get into a car to come here.

Sara Constantino

On a positive note, I think teaching and creative work will be some of the last positions to be automated, at least according to McKinsey's report.

Gabriel Fries-Briggs

It seems like the nightmare is that we'll just end up in a room talking about automation forever and all the interesting things will be made somewhere else.