FORENSIC METHODOLOGY

How does architectural research work?

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The development of research methodologies might be understood as a complex editing process. Methods are unstable and adaptive, evolving in response to changing conditions and findings. Tools and techniques that were formerly reliable and productive may suddenly seem ill-fitting or obsolete. Unexpected results may challenge assumptions and force the construction of new regimes for gathering knowledge. Ultimately, any particular methodology is defined both for and by the research itself.

"Forensic Methodology," a symposium hosted by the Applied Research Practices in Architecture (ARPA) initiative at the Columbia GSAPP, welcomed a diverse group of influential researchers to open up their methodology to critical examination and discussion. The event, which was hosted at Brownie's Cafe, GSAPP's most public setting, sought to emphasize the discursive function of forensics—that is, the presentation of evidence and arguments for public consideration and discussion.

In the first panel, entitled "Practice in Research," historian of science Orit Halpern explored her approaches to collaboration and the diversification of research methods
historically, and robotics engineer Hod Lipson discussed his lab's development of artificial intelligences that learn about themselves. In the second panel, "Research in Practice," architect Andrés Jaque led a tour through his own research-driven and politically active projects, and architect, urbanist and critic Michael Sorkin probed the broader role of research in the practice of architecture and urban design.

In each case, method appears crucial to the performance of the research. But what is its role? How are methods constructed and used? By focusing on how particular research practices are conducted rather than what the subject of research is, we hope to better understand the agency of research within architecture and other fields of knowledge.

The proceedings published here extract and interweave key themes that cropped up throughout the event. Rather than reproduce the linear flow of the discussion, the selections from the transcripts are organized under thematic headings: Method, Forensics, Practice, Difference/Diversity and Knowledge. In no way do these categories suggest an exclusive interpretation. Complete transcripts are available in .pdf format: Part 1: Practice in Research and Part 2: Research in Practice.

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METHOD
Method is not a fixed object that is applied, refined and repeated. Instead, as the projects below suggest, method is an adaptive function that operates both within (as a set of tools and procedures) and around (as critique and analysis) the process of research. It is immediately revised as the conditions of the phenomena of investigation change, and gradually shifts as the researcher becomes aware of his or her own assumptions or fixed patterns. Method can even itself be the object of inquiry, producing new ways of thinking about problems at hand.

ORIT HALPERN: [00:15] Today, I want to talk about this method thing, and how much we love it. With so much data and analytics we always seem to want to optimize; analyze; make resilient, robust or sustainable anything and everything. There are so many solutions. There's so much smartness. It's as if ever since the mathematical theory of communication, all we can do is focus on the shape of the channel. If once urban planners and designers loved to identify the standard urban form—this is how we imagine what you guys did, but by all means, correct me—now we like to find the standard algorithm. Now it's all process and method. All of this in the hope, of course, that we won't actually have
to deal with each other; that we can just be like the ants or the bees and generate brilliant self-organizing systems, as though there were no hierarchy in hives. (I just thought about the Freelancer's Union advertisement in the New York Times and the New York subway). It's as though we can avoid what used to be called "politics" and assimilate the ecological insecurity and financial instability into our lovely environments.

... [00:17] But all these methods can get stuck. Jammed. Rotated into familiar and stuck patterns. Now that we all love our methods, what keeps us from getting stuck? I want to look at the way people get stuck and imagine other approaches. In 1951 Claude Shannon, author of the The Mathematical Theory of Communication, built a maze-solving machine. To exhibit it, he staged a little performance. In fact, cybernetics is filled with these performances.

... [00:18] This performance was staged at the Macy Conferences on cybernetics in front of an assembly of some of the foremost scientists of the time in fields ranging from behavioral to social to physical sciences. It's commonly touted. The anthropologist Rebecca Lemov, to whom I'm indebted for this tale, has already signaled that it was the beginning of a new concept of the human sciences. But this story gets told a lot in the history of cybernetics. I'm sure all of you have already seen this little machine. The videos have gone viral. The machine—the little robot—had a finger for sensing direction, a limited memory and two types of strategies. It could goal-seek and it could investigate. Though operating in a jolting manner, the "animal" robot eventually found its way through the maze. When it reached its goal at the end of the maze—in a seeming moment of self-recognition of its achievements—it rang a bell, lit up and then turned off. All the people that saw it were highly excited and convinced that the system and machine interacting in the maze could learn. Indeed it possessed positively lively characteristics. Shannon went on to provoke his audience further by demonstrating a total control failure. The mouse was a machine capable of conditioning and it could learn one strategy: a fixed strategy. Having gone through the maze once, it would switch from investigation to strategy mode. Having learned one strategy or algorithm—say if you hit "A," go to "B"—the animal machine could re-navigate the maze backwards, assuming the maze was exactly the same. (That's a big "if.") If, however, the maze changed, there emerged a problem. Trying to replicate the old solution in new conditions led the machine to violently bump in circles, repetitively injuring itself with no end. Stuck enacting this repetitive automism, the small mouse incited observers to label it pathological and neurotic, even, "positively Orwellian." Shannon assuaged and reassured his spectators, however, that there could be a technical solution: an anti-neurotic circuit breaker.

How do we break our own habits? You can cut in, change the circuit, shift and actually...
erase the memory of the machine, allowing it to miraculously commence with its activities once more. In demonstrating the infinite human potential for rethinking machines, the mouse also demonstrated the somewhat cyclical and mechanistic dangers that come with thinking the world only as a matter of preprogrammed logics.

... [00:24] Shannon's mouse teaches us some lessons, as does the entire cybernetic zoo. Cyberneticians love doing experiments that perform. It's an anti-method method. Instead of starting with a hypothesis, you start with situations. From a condition of possibility, we'll form and then learn. But of course, you can always get stuck. How do we experiment and also improvise? How do you not get what you're looking for? This is something that preoccupies me ethnographically: how do you actually listen to your data? How do you find new stuff or break the preconditioning of the data that comes in?

HOD LIPSON: ... [00:32] I'd like to talk about our processes of designing robots. ... The message I'll try to argue is that algorithms and artificial intelligence (AI) are the way to get "unstuck." We humans get stuck in our thinking very frequently, and algorithms might be able to save us.

... [00:36] According to Darwin, "it is neither the strongest nor the most intelligent of the species that survive, but the one most responsive to change." Adaptation lies at the core of everything—of life. How can we make machines that are more adaptive? Speaking about methodology, here's the controversy, at least in engineering. When we started making our robots we said to ourselves, "forget the old method of making robots that involved people sitting at desks, designing a robot, wiring it up, demo-ing it and doing all of those things. Forget about the human in the loop, because it is the human that gets us stuck." Let's allow evolution, or AI, broadly speaking, to evolve design problems for us.

We threw into a big vat lots of robot pieces: wires, motors, bars, joints and many other components (I'm talking about a big simulated vat, not a real vat). We created a big physics simulator for these pieces, and we let evolution put them together in many random ways. The criterion for breeding these robots was that we wanted a machine that could move. So, we said, "Let physics run its course. Let's see which robots move faster. The ones that move faster will get to breed with other robots. They'll have offspring and maybe those will move even faster. If we keep on doing this for a thousand generations, eventually we might get some interesting machines." That was the idea. It's very hands-off. It's a total surrender: "Let's see what we get."

This was back in 2000. Our big 16-core machine, probably slower than the cellphone you now have in your pocket, was a big deal back then. This was not the 50s, but still, it was a very slow machine compared to today. We ran it for a week and plotted our progress over time. For the first hundred generations, nothing happened. We just got piles of junk with wires and motors attached to them. They couldn't move anywhere. There was no progress. But then something happened, around the hundredth generation, in which wires connected to motors in such a way that some piles of junk begin to vibrate. These vibrating piles of junk moved a little bit—not a lot—but that was infinitely better than the others that didn't move at all. They began to take over the population. And after several hundred generations they improved, through these punctuated equilibria as performance improved in fits and starts. After another week went by, the robots could crawl across the simulated floor.
... [00:40] Of course, to satisfy the demo criteria, we physically built two of these machines, and had them crawl across the floor. We used a 3-D printer. I think these were the first-ever 3-D-printed robots. This was back in 2000. They're printed in one shot. These robots were liberated from the simulated world into the physical world through the 3-D printer.

... [00:42] Our robots made the New York Times front page with headlines like, “Robots Building Robots: The End of the World Is Near.” That didn't happen. But I did get my faculty position at Cornell, which was a good outcome of that process. Still, I knew I was not going to get tenure by making plastic robots. I needed to make robots out of titanium. In mechanical engineering, this was the least I could do, right? So, I built an incredibly complex machine. It has a paintball canister in the center, lots of valves and pneumatic actuators. It's just impossible to control. My idea was that if I can make this thing gallop in the field, I will beat my colleagues who are control theorists. If I could get my robots to beat the performance of these other people’s, then I will surely get tenure. So, I built this machine. We got a bunch of students. We put the machine in a big cage and we let it learn. Our process was to leave various controllers, or “brains,” alone overnight and let them compete. The better ones got to reproduce with other good controllers. There was a camera that watched the robot to see how well it did. At the beginning, it didn't do very well. It didn't move very fast at all. But over time, the robot learned how to walk through a self-learning evolutionary process.
was great. But the problem was that you can do things in simulation that don't necessarily work in reality.

... [00:45] In my fourth year at Cornell—and I'm getting desperate, as I have to hand in my tenure package in the fifth year—I thought, let's start with a very crude simulator that doesn't work very well. We're going to use it to breed robots, take the best robot and build that in reality. Because the simulator is not very good, that robot is not going to work very well. Nevertheless, we're going to collect data about how that robot performs. What kind of data? We're going to collect actuation and sensation, motor commands and accelerations, actions and sensations.

We take all of that big data, and we use it—now, this is the key point—not just to breed robots but to breed simulators. We breed models of the world.

Just as we had bred robots, we now use this AI evolution to design models of performance and predict how it's going work. The simulators and robots co-evolve, like predator and prey, or maybe like student and professor. They help each other, but they're also somewhat antagonistic. Because in an arms race, everything takes off.

The last project was this one: it's a four-legged machine that has eight motors, with two on each leg, one at the hip and one at the knee. It also has two sensors that measure tilt one left and right, the other forward and backward. This robot needs to learn how to walk, but the trick is that it does not know what it looks like. It does not know that it has four legs. Imagine yourself sitting in a black box with no windows. All you have in front of you are eight knobs. And as you turn the knobs, you can feel this box tilting. That's what this robot feels. It has no notion of whether it is a tree, a spider or a snake. Maybe this is not unlike what the brain of a newborn baby feels, where self-awareness begins.

The way this robot works initially is that it moves randomly. It babbles. It moves its motors around and begins to create hypotheses, or models, of what it might be. And then—this is the critical step—it tries to disambiguate these models by seeing how the motors' movements make these models disagree in their predictions. For example, by moving motor number seven it should feel a tilt this way if it's a snake, and that way if it's a spider. If the spider self-image and the snake self-image disagree on what would happen when you move motor seven, so that would be a good experiment to do.
A good scientist designs an experiment that causes two theories to disagree in their prediction. That's the key to science. And that's exactly what this machine does. We try to embed, in terms of methodology, automation within the process of exploration. Here is a video of our first runs (and in robotics you always have the camera rolling, in case this becomes the last time the robot will work). Here it is, trying to create a model of itself. It died. That was sad. But we plugged it in and we tampered it a little bit, so it didn't move too violently.

The next time the robot explored itself more timidly and created models of itself. All the models were initially wrong. But the models all enabled the robot to explain the tilt of the box correctly, so they are valid hypotheses. After about eight out of sixteen trials into the run—over about four days—it begins to realize it has four legs. It doesn't quite know how they're connected, and at what angle. But after sixteen trials it created an accurate model of itself. Remember, we're after consciousness and self-awareness, right?

Eventually, the robot uses its self-image to figure out how to walk. We can peep into its imagination, and then see the robot walking in reality. Frankly, we were hoping to get an evil spidery walk, but instead we got this sad way of moving forward. Still, you have to remember that the robot did not do walking tests before. It did not have a model of itself, nor was it programmed to walk by a human. All of this is spontaneous. The robot figured out how to move forward.

... [00:52] To sum things up, we try to get machines to learn. The challenge is that we can't work entirely in simulation because we lose track of reality, but we can't work entirely in reality because it's too slow, expensive and risky. So, we ended up with the idea of machines that learn to simulate themselves. When they learn to do so, they can start designing and exploring on their own, much like you and I explore our options in our imagination of the world, and not in the real world. In two examples shown today, the robot designs its shape as well as its behavior.

MICHAEL SORKIN: ... [02:01] What, at the end of the day, isn't research? I assume any broadening of experience—whether accidental or deliberate—meets the general categorical criteria. Reading (or writing) Proust, a Situationist derive, a wine tasting, a sketch, a wet finger to the wind, smashing atoms, shining Luminol on the carpet to illuminate the bloody trace (we're addicted to that TV program Forensic Files at our house) all surely lie within the territory of investigation. Should we make distinctions? Of course! So, let me invent some categories or, since I'm winging it here on short notice, probably reinvent.

There is a kind of "pure" research that thrives on a buildup of the speculative and elaborates itself via continuous overlays of augmented experience. This is the territory of, among other things, psycho-geography, of a simple setting out, of a sensitized set of observations and interactions that are the typical purview of the flaneur. Here research is structured as narrative and the researcher is in the position of reader. Things proceed directionally, surprises occur, the anticipated is sometimes realized, and the conclusion marks a moment when one has, at least provisionally, completed the whole of something. That whole is then subject to ongoing revision, recollection, and analysis. Such research is especially interested in the context of the city, given that it can never be completely read because of both its extent and of its perpetual state of flux. Any reading of the city is thus a form of patch dynamic investigation, artificially constrained and distorted, an assertion that the city is always multiple. This can be highly useful to the accretion of ideas about the atmospheric, of the conditions that define action and intervention.

Perhaps the most familiar and traditional form of architectural and urban research is operational, research that involves the test of some system or principle against a form of regulated and benchmarked reality. This is comparable to what happens in a wind tunnel or on a shake table and it focuses not on the fundamentals of invention but on refinement of something that's already conceived but, at least provisionally, short of "optimal." What camber in the wing produces the most lift at low speeds? What kind of gasket most effectively seals against the rain? Depending on its motives, this can easily cross various political and ethical thresholds. The time and motion studies of Frederick Winslow Taylor, while conducted under the aura of that old bugbear of "scientific objectivity" had the result of helping engender the Chaplin-esque nightmare of modern times, the rigorous regulation of workers and their more efficient exploitation by the bosses. On the other hand, the operational research of Masters and Johnson may have had more salutary effects.

In robot design, the models are too abstract and the sensory experience too crude to be of much value. There is a need for "invention" in the literal sense of the word, a need to invent some categories or, since we're winging it here on short notice, probably reinvent.
committed to its inerrancy. This is how space opens for one paradigm to question that exceeds the capacity of any present account to overcome some observer’s skepticism. The grounds for such doubt can arise from a speculation I’ve test—the current version of the way we go from Newton to Einstein. Hypothetical research from a much more numinous and interrogate and interpret images that are propagated as shadows of something research, the hypothetical sort depends results although here, too, possibility also readily links itself to imperatives to perform against desire.

*Hypothetical* research is, again, an “impure” category but it’s different from the idea of speculation I’ve just proposed in having more teleological *oomph*. Unlike speculative research, the hypothetical sort depends on knowing clearly what you know but not being committed to its inerrancy. This is how space opens for one paradigm to replace another, the way we go from Newton to Einstein. Hypothetical research always poses some question that exceeds the capacity of any present account to overcome some observer’s skepticism. The grounds for such doubt can arise from a particular piece of evidence or from a much more numinous and inexplicable insight. In our terrain, the hypothesis might be zero-energy building, an autarkic city, a morphing architecture, or universal access to decent housing. This is research that inevitably demands that we cross—at least the current version of disciplinary boundaries, that we remake our epistemology, our way of knowing. Whether these border excursions are useful must be tested operationally.

I don’t have the language to describe *interior* research with any degree of authority, but we’re all deep in it. Psychoanalysis has been called the mother tongue of modernity and the excavation of the unconscious is perhaps our most quotidian and personally urgent form of investigation. This resembles Plato’s famous cave in that we’re obliged to interrogate and interpret images that are propagated as shadows of something else. We have many techniques available to give these shadowy perceptions form, ranging from stream of consciousness, drugs, conversation, writing, to the couch. I hope you will attend Rebecca Solnit’s lecture on Thursday at CCNY because she is such a skilled and articulate interior geographer. Her special genius is to map both the inside and the outside of the skull at the same time. By investigating relationships between phenomena that are at once divided and dependent she conceives of a social and individual spatiality that is simultaneously shifting and singular. What distinguishes this from more purely speculative research is the way in which it is so deeply and inevitably informed by history in all its privacy and plurality.

What we’re all really interested in at the end of the day, of course, is *formal* research. I have nothing special to say about this, save to suggest that formal research—by which I mean the investigation of physical morphologies—can be a first- or second-order investigation. This may simply be another way of declaring *de gustibus non est disputandum*. I like mountains, puppy dogs, and rocket ships and—over the years—have done work with visual affinities to all. Likewise, I love Fez, Prague, Manhattan, Hutongs and the beach. And I like lots of the wild and crazy shapes that comes out of the computer. Form begins wherever you find it, and formal research consists, in the first instance, of a kind with investigative botany or zoology, plying the jungle for objects and for processes that generate objects until you find something that moves you. There’s nothing wrong with a mimetic sensibility, and nowadays we’re all into—to name one particularly tasty case—biomimicry: the purportedly right mimesis for our environmental age.

This roundtable was called under the banner of *forensic* research, and everything I know about this I’ve learned either from TV or from Eyal Weizman and his collaborators. I’m not sure why this was chosen for your title but it does carry the imputation of criminality, of the practices of unearthing evidence to be weighed in a judicial setting. While all research is subject to evaluation and analysis, forensics is a special case, less for its methods than for the kinds of outcomes it is meant to support. A forensic investigation must be distinguished, for example, from an archaeological one not because the standards of evidence or the techniques of inquiry differ but because there is invariably an ethical valence to its conclusions. I would caution against a too promiscuous use of this concept lest we diffuse its vital relationship to justice. Post-occupancy analysis, for one, is both linked and other.

But back to form. Over the past couple of decades, a major problematic in defining the meaning of the research people like us do has surely been found in the widespread reverse engineering of formal authority as the outcome of the generative procedures that produce it. To be sure, we've moved on from the days when the certification was simply a random collusion of personal, historical, or other “facts”—capturing the precise configuration of the stain from yesterday’s coffee cup on the drawing, the trace of
capillary action and the minute puckering of the page yielding the project—to the more automated forms of parametricism, which are too often held to be ipso facto all right. We likewise remain overly infected with that Dutch disease, too impressed with data, which itself becomes a form of automation, and rely too much on its certifications to sanctify some tedious singularity or another, pretending that statistical intelligence is somehow completely neutral. Pile it on and the project authentically ensues. Bastal. Genug! Get over it!

The eternal issue for formal research—what distinguishes it from “formalism”—is the question of how its meanings are attached. For architecture and urbanism, “looks good” is an important but insufficient criterion. Any inhabited work that lives in the space we share (the planet) must be vetted not simply for its contents but for its effects. This research into the meaning of the outcomes of research itself might fit into the operational variety but in a highly expanded version. The examples offered before were technical, but architecture’s effects cannot, in fact, be isolated from the social—indeed, the ethical. Whether this devolves on program (the AIA is still happy to have you design gas chambers), materiality, or the role building plays in distributive justice and, indeed, in the very idea of collectivity, it is central to our practice. If you ignore this, you are a bad architect. Research on real outcomes is a medium through which we establish both our relevance and our virtue.

... [03:14] [Earlier today,] I had to sit on a review at City College. It was a studio that was very research-oriented and it’s important to both evaluate the work as presented as well as to relieve students of too narrow a vision of what constitutes research. In many studios nowadays, there’s an assumption that sufficient research will yield, first, program and second, form. The pedagogical struggle is to try to release students—and this is a broader problem in architecture—from a kind of constraining homology between research and its representation. A certain narrowness of latitude to represent research — as well as the protocols and boundaries of investigation—in the environment of an architecture school must always be questioned. If all research is reduced to a set of graphic inventions, then the core research risks being lost in translation. I think an important measure of teaching is to insist that this reductive response to the substance of research gets you in more trouble than it saves you.
ANDRES JACQUE: ... [02:39] I would like to talk about some of the projects we have been doing over the past few years, starting with a project that we call “PHANTOM. Mies as Rendered Society.” Even though we tend to perceive Mies van der Rohe’s Barcelona Pavilion as something that only has one floor, those who reconstructed it in the 80s built a basement. To me it’s very important to see that basement. Through it, the Barcelona Pavilion produces and conveys knowledge. We tend to think of research as something that precedes architecture. But I think it’s important to see how architecture is actually engaged in presenting evidence; and in producing, communicating and testing knowledge. The pavilion does this by making distinctions between the ordinary—for instance, what happened to be in the basement—and the exceptional.

... [02:41] In the basement we can see the remains of failed experiments from upstairs. For
instance, Plexiglas panels from the bottom of the dark reflecting pool above were removed because they curved due to overexposure to the sun. They were stored below to present the building as though it has been created at once, directly from Mies’ head into matter. This is very peculiar, in my opinion, because it means we need to hide the experiments and tentative steps that are needed to produce material realities.

I love these basement remnants. They have a certain beauty that reflects the things we could discover in Mies’ architecture. Mies is present in them, but in a different way than he appears upstairs. For instance, we see downstairs the velvet curtains that have faded out. Upstairs, they are dark red. But when they start to fade, they are taken to the basement. In cosmo-political terms it’s super-interesting. Everything influenced by nature is hidden —ordinary things like the office, the place where the employees do the dishes and eat, and even the place where the cat Niebla, who removes mice from the upper floor, lives.

So, in terms of methodology, we worked in a forensic way even though there was no crime (well, there was a certain crime, because all these things were removed from the upper floor). We looked carefully at what’s kept in the basement and tried to reconstruct a story by interviewing people who work in the pavilion. We interviewed Victor, the manager; Roy and Isabel, the architects in charge of the maintenance of the building; Fernando Ramos and Cristian Cirici, the architects who reconstructed the building; and Manuela, one of the cleaning ladies. All of the realities removed from Mies’ idealized experience created evidence that circulated in the networks of the building. The basement removes anything that would suggest that this exceptional piece of architecture actually comes from the ordinary world.

What we did then was to remix things, to trouble this dialectic between the extraordinary and the ordinary a bit. We brought evidence upstairs. We made it possible to see the realities and social connections that make the pavilion possible.
Peter Eisenman Transparent.” We wanted to make transparent, for instance, the amount of money that was already spent (this feature was removed from the project for very obvious reasons). We made visible the scope of each construction company operating there. Signs placed on all trucks coming from and going to the building site showed the extension of the building site within the landscape, or within the project's territory. So, we could see, for instance, that marble was brought all the way from Italy to Galicia, one of the biggest producers of marble in the world. All of these kinds of things transformed aesthetic and technical decisions into social concerns in a material way.

The idea was to think of knowledge not as something that clarifies decision-making among designers but as something that could socialize knowledge and enable an audience the opportunity to discuss technical decisions.

**FORENSICS**

The term “forensics” is rooted in the concept of a public forum. It is in one sense the art and science of producing evidence-based arguments for the adjudication of facts. Applied to the practice of methodology, forensics is also the act of making certain complexities visible without ensuring a stable outcome. During the symposium, established socio-political structures inherent into different collective behaviors were deconstructed and debated, opening up the potential for new types of political agency.

LEAH MEISTERLIN: ...[1:21] [W]hat would ethical evaluation look like in a world of smart machines? What would a robot capable of ethical determination be? I want to see that robot.

OH: I don't know if human beings are capable of ethical determination [laughs].

AUDIENCE [DAN TAEYOUNG]: My question is about hidden settings or defaults. Based on my understanding of genetic algorithms, I understand that the research question is often less about “why is this leg moving?” and more about “how did this leg come to move?” or “how was this leg generated?” or “how was this specific chromosome generated?” Hod, it seems that for you as an engineer, the process of creating robots might be one of joy or wonder at watching one's progeny develop. On one hand, you know what the “hidden settings” are. You know to use MOGA-II or another specific multi-objective optimization algorithm; you've determined what settings to use. On the other hand, you also have the joy of watching something literally evolve outside of your control. It's a little bit like what having a child must be, perhaps. A million generations of evolution later, the response to
the result of the genetic algorithm is: "Oh wow, look what I discovered! I know exactly what I put into it, but what came out of it is different." You can't ask the question "Why is this child the way it is?" The question is more about "How did it come to be this way?" Your relationship to research maybe involves initial deliberation about the hidden settings, then wonder at how the results were born.

I'm contrasting this with Orit's presentation, of an apprehension of the algorithm, which asks, "Why do these things happen? We don't know the hidden settings, so our only answer or our only recourse, is to ask why the algorithm operates the way it does." Perhaps there's a difference between the engineer and the user, which is made political, because not everyone gets to understand the hidden settings. Hod, you know how your genetic algorithms work, and so you know why they will also fail. For that reason it's probably an incredible delight—it was for me, anyway—when you see a robot gain comprehension over its own self, in an incredible, nearly philosophical method of self-inquiry.

My question then, is what are the "hidden settings" for you? Algorithms have immense impact and we are thus modified by them, to a large extent, because there's a landscape of algorithms that we don't know the hidden settings of. On one hand, if one doesn't know the hidden settings, one can only ask, "Why do these algorithms work the way they do?" And on the other hand, for those who understand and manipulate the hidden settings as part of their research, the process is one of joy and exploration: How do these things happen? What are the hidden settings, and how have they changed? How do you change them in order to change what you discover from your research? After all, it seems that you're able to have a unique emotional stance toward the algorithm in your research.

OH: That's an excellent question. One thing I want to say is that I quite love algorithms. I'm a historian of them. I like that large-scale systems can challenge our narcissism. No matter how well we know how the algorithms work, we never know what they're going to do at full scale and at higher degrees of complexity. I love that, in some sense. It also challenges us, again, to be creative in the face of radical uncertainty, even though we think computers are so bounded and known. There's something in me that wants to activate the fact that I don't know everything in the world. That's OK. No one here does. I want to find a mode of wonder, or a way to make this an additive relationship.

The inverse perspective, of course, is that there is a politics of the black box, and what gets black boxed and what doesn't. That's a very serious site of intervention and tactical concern. As a social scientist and historian, one of my tactics is to make visible, or knowable, not only the how but the why—not a causal why, as in, "Here's an easy reason: A = B." Rather, I'm interested in producing sites of investigation where interventions can be made. Smart cities are great examples, as are financial markets. There are a lot of places where a black-boxing can be undone. Even if you know how an algorithm's going to perform, you won't know what it will do at different scales. There are emergent properties. I find this interesting as it raises potentially imaginative and creative opportunities for us back in the human world.

A.J: ... [03:04] I believe that architecture mediates and prompts engagement in the production of knowledge. It can enable political mobilization of knowledge produced in the margins, and confront mainstream knowledge.

... [02:45] Ikea is probably the most important architectural agent these days. Their capacity to produce architectural experience, everywhere, is huge, and the messages it sends intensively shape the way we see daily life. We looked at the 2007 ad campaign that claimed the house as an independent republic, or a "kingdom." Domesticity was seen as isolated from many of the processes by which the social is disputed and constructed. It's as though you leave behind all the conventions of the outer world when you arrive at home, and somehow gain political independence there.
We interviewed many people to study how they develop their own domesticity. We found that Ikea produces a reality that is not universal; people actually engaged in political projects from their living rooms, kitchens, bathrooms or bedrooms. Domesticity is less an independent republic for these people than the center of many political engagements.

One of the people we interviewed was Bertha, who came from a tiny village to a squat for lesbian women. She organized the architecture in a way that produced an upper space for intimacy—where the residents could minimize the risk of changing the way they relate to their bodies or to their sexuality—and a ground floor that promoted a transformation of the way the neighborhood sees lesbianism. The process of finding her sexuality and even her body could never have happened without this space. Now Bertha is actually a male, and the whole transformation of her—of his—body is related to his association with a very particular architectural device: this squat.

We saw many other examples, including Maddie, who transformed her TV room into a hairdressing salon as a space for sociality in Long Island City. By making an archive of similar cases, we could counterbalance the depiction of reality prescribed by Ikea. We could see that research played a political role by bringing forward alternatives to mainstream messages. Architecture has a long tradition of producing research as a political tool, bringing diversity and alternatives to particular domains and discourses. It's very important for me that research is about making things visible. By accounting for the way domesticity is produced, we could recognize how the material reality of architecture had been produced.

MS: ... [03:24] If there is, in fact, an ethical dimension to what you do, then it is your obligation to create the rhetors that will produce persuasion. In the Downton Abbey, Upstairs Downstairs theory of the Barcelona Pavilion the rhetoric can easily serve more to obscure than to reveal. It's incumbent upon us to unpack and address the distortions—and utility—of our own means of persuasion. Again, we must rebuff the myth of correct procedures and the value-free nature of “scientific” research. That's really all I was trying to say in today's talk. Research should be liberation! When you step out the door and walk down Broadway, it's research. When you daydream, it's research! If you are sitting in an institution that negates the possibility of your profiting, as it were, from the set of impressions and observations that you make in your quotidian existence, then you're in the wrong institution. Fix it!
PRACTICE
The practice of research is as heterogeneous as the definition of the term itself. Each speaker practices as a researcher in an academic setting or incorporates research inextricably into their practice. There is a reciprocal exchange between research and practice. And in either case one might draw from an abstract or autonomous invention, while another can consider existing conditions, analyze them and intervene from within.

SUSANNE SCHINDLER: ... [03:05] We are in a university setting right now. You both teach at universities. Yet neither of you mentioned the role of the institution in your research. Could you speak to the difference between your capacity as a professor and as a practitioner? In particular, how do you fund the research? Could you expand on the relationship of the university, the office and money?

MS: What an unbelievably crass question! [Laughter] When we started the nonprofit, our fantasy was that our for-profit office would cross-subsidize the non-. Unfortunately, although they are legally distinct, they're both hemorrhaging money, and Terreform is obliged both to forage and to rely on the kindness of strangers, including volunteers who share our goals. We all have rightful anxiety about the exploitation of interns and we will accept no unpaid intern in the professional office. But our approach in the nonprofit is different. This is work for a cause. We pay a core staff, but I donate my own time and don't think it's improper for others to voluntarily help out if they share our commitments.

The university is more problematic. The question I asked myself at the get-go was, “Shouldn't this Center for Advanced Urban Research live at the university?” The answer was “no.” Part of this had to do with the particularities of my university. And part of it had to do with a more basic idea about setting agendas, controlling outcomes, and sharing responsibilities. This obviously cuts both ways.

Still, I don't see my own broader “research” project as discontinuous with what I do at CCNY. What I do is what I do and it takes place at different sites and in different registers. But the space of teaching has a sacred character which demands that it be, to a certain degree, out of my control. A large part of teaching is about authorization, giving permission trying to cut people free from constraints and bad habits. I insist on a policy of persuasion rather than prohibition, and sometimes I can't make the case. There must be much more latitude in the work a student does in the academic context than in a more structured environment, where someone else finally calls the shots and things are more hierarchical within the collective. Although I try to steer my students and offer them encouragement and what I hope is good advice, they must finally find their own direction within the constraints of the problem. Which means the obligation of the researcher is very different in the two circumstances. To me, the first duty of the student is self-liberation. The obligation of the researchers in our laboratory has to do with a hypothesis and a series of efficient methods for testing, revealing, and sharing it.

A.J: ... [03:10] The work we do in the office looks carefully at the situations in which we get
just a kind of experiment for innovating on human life itself. Prove that your idea works in a world of smart machines and seemingly stupid spaces? And of course, ethical evaluation in a world of greenfield developments like the Songdo, which are considered test beds or demos for the future of life. People don't even care if these things succeed or don't. The whole thing is just a kind of experiment for innovating on human life itself. Gökçe Günel, who's here today, and I have talked about this idea of apocalyptic hope and precarity, a sort of experimentation with the end that we embrace lovingly so that the end will never arrive. This constant demo-ing defers a conclusion. So, we're forced to ask about the relationship between these experiments and reality. What types of inquiry can the social sciences develop to address these self-enclosed and autopoetic worlds? How do we simultaneously embrace and reimagine this culture of the test bed and the performance? And of course, other questions emerge: Where are observers situated? What are the boundaries of this laboratory? Where does the world start and end? What sort of actions can create mirrors that produce different realities and help us address ongoing moral, ethical and political inequalities while generating new images of the world? What would constitute moral and ethical evaluation in a world of smart machines and seemingly stupid spaces?

HL: ... [00:44] Orit, you asked why there are so many demos. The demos are necessary to prove that your idea works in reality, not just on paper. That becomes necessary as we approach and experience infrastructures. We often ask how to represent things. But if we look at a process that we want to intervene within, there are already forms and representations under discussion, and uses of technology that could be empowered or transformed. Architecture or design never happens in a tabula rasa. There's already a context, tools that have been developed in any field, and other representation methods we can kind of appropriate. The same is true with the use of material devices. So, in my opinion, it is important to connect design with research by describing and detecting material realities that are already happening.

Oh: ... [00:29] In my work I try to generate new forms and create counterintuitive mappings to generate research that is not deductive, necessarily, but rather, additive. A friend of mine that works with improvisational dancers likes to call it "adduction." It's almost like you're seizing something out of the world and trying to take it on. How we add to the world, in many ways, is a major role of critique. So, for us, naming and performing is a creative process, a poetic undertaking. And like a good poem, suitable metaphors provide novel viewpoints and new insights into the digital world. Like a poem, it's also performance. People make accounts, experiences and even furniture that can rethink how we approach and experience infrastructures. I'll... paraphrase Dostoyevsky: We all know the answers; it's the questions we don't know. In an age of methodolatry, what does it mean to improvise—to add to knowledge and practice—and to perform with signification?

P: ... [00:18] Performativity is quite critical for me, as a strategy, as a method and as a way to think through and work with problems. One of the questions, of course, is how one creates different types of performance. What is the relationship between performances, demos and prototypes? Do demos always have to come along with death, as in Nicholas Negroponte's "demo or die" mantra?

HL: ... [00:47] Orit, you asked why there are so many demos. The demos are necessary to prove that your idea works in reality, not just on paper. That becomes necessary as we approach and experience infrastructures. So, when teaching students—let's say at an urban scale—we are interested in how things are brought together rather than defined individually. For instance, the city was produced in relations that were inter-scalar. You might have breakfast in one place while something related happens at another. We wanted to clarify the process in which students could participate in a discussion of things that happen simultaneously at different scales, and produce new ideas out of it.

This is a process we don't need so much in the office, because we don't have that big a responsibility to other communities. We do talk with clients and stakeholders, but in a way that could recognize the architectural disciplinarity of our discussion, even though we wanted to do something in, say, Madrid's cultural context and not just a response to the architecture field.

... [03:37] We often ask how to represent things. But if we look at a process that we want to intervene within, there are already forms and representations under discussion, and uses of technology that could be empowered or transformed. Architecture or design never happens in a tabula rasa. There's already a context, tools that have been developed in any field, and other representation methods we can kind of appropriate. The same is true with the use of material devices. So, in my opinion, it is important to connect design with research by describing and detecting material realities that are already happening.
machines (and ideas) become more complex. The process only worked for me in my first project because the robots were very simple, but it wouldn't work for complex things. That was a problem.

DIFFERENCE/DIVERSITY
Difference marks the site of something interesting: when a variable changes and produces a difference, a researcher may stumble on something worthy of deeper investigation. Likewise, within research strategies, fields of difference produce an ecology of competing explanations and methods. Computational strategies, among others, can explicitly address these properties, and operate simultaneously on specific problems and broader methodological concerns.

LM: ...[1:04] In business design research circles at the moment, the question of how to engineer serendipity has gained currency, whether to apply algorithmic or programming thinking toward the environments in which human beings are asked to collaborate and innovate. Whether we are successful at innovation in those fields comes down to the degree of pluralism within the environment—pluralism among actors, agents, intellectual diversity or diversity of their capabilities.

Along the lines of difference and differentiation, how do imagined outcomes play a role in the way you both think about research and the design of a methodology? Hod, you speak in terms of the robot's ability to produce the right or wrong outcome. We know what it's learning to do. We know what that outcome is. Whereas with more open-ended questions or in conditions in which an outcome can take multiple forms, how might methods be designed or considered in the first place?

Oh: I wish I had an answer! “Having lost Utopia, we now can provide you with three easy ways to envision it!” I think that's a constant struggle. I think it's, again, very much about creating conditions of possibility. In some sense, this question about simulation and performance is less about the difference between the laboratory and the world as much as the different environments that produce varied potential modes of creating. There are many projects I've done with people in which we've tried to imagine—and this is a very common strategy—a counter-history. You reimagine this problem or that solution. What if the water rose? How would you design? What if, what if, what if? We think hard about how to produce places where speculative games re-engage ethnographically and historically with data. And that forces the question of whether the way we frame the “what if” is even the right “what if.” In some sense, there has to be iterative feedback when what you're
finding about the world forces you to reconceive what you imagine the world to be.

One of the issues behind forensics—and it depends how you understand it and how tightly we define the term around the question of what constitutes proof and evidence—is that you’re constantly trying to learn from what you’re actually gathering from the material. That’s going to constantly reconstruct your understanding of an event and your projection of its future.

HL: Likewise, I think that’s a very interesting and difficult question to answer. When we let our algorithms loose, we set criteria that are very simple, like how fast a robot can move. Apart from that, it’s very open-ended. One thing that can kill the entire process is lack of diversity, exactly as you said. If we don’t have some measure that encourages diversity in the population of ideas that are competing, the outcomes converge, the winner takes all and we get no good competition of ideas. We very quickly get something that works but it doesn’t continue to grow. That’s the end of the game. We, and the entire community of people working on evolutionary design, spend a lot of time figuring out how to get diversity to happen. If you Google “diversity maintenance in design automation” you will find tons of papers trying to do this in a very methodological, computational way.

If you have one criterion, you’re dead in the water. You have to have multiple criteria with a whole Pareto front of solutions. Diversity comes from the fact that you have many different criteria, not different ideas. If you have just one metric, then you’re not going to have a lot of diversity. That’s the bottom line of what we learned the hard way, computationally. Let’s put it this way: If the business design researchers only think about one criteria, which is how much money the business makes, they’re not going to get diverse results. The people who design criteria also need to be diverse in their thinking about metrics. Then they’ll get many solutions. That is happening in DIY movements: We’re creating other criteria for what it means to be successful. That’s what we’ve learned about diversity, in computers, so it may or may not transfer to humans.

KO: KNOWLEDGE

Research may seek to produce and advance knowledge, but knowledge is not always the end result of research. At every step of an investigative process, knowledge exists in different forms and at different levels of resolution. It remains open to interrogation and further development, even as the starting point for a new inquiry. The projects presented in this symposium approach, gather and produce knowledge differently—recognizing its significant value and adapting it in order to develop new ways of instrumentalizing it.
The cybernetic zoo was very varied, from William Grey Walter's little robot turtles that fell in love with each other, to Gregory Bateson's porpoises, to simulations of disaster in nuclear wars. But there's a big difference, I think, between the playfulness enacted in these experiments and simulations with a known endpoint, tested by the game theory conditions. We tend to put all the communication sciences together—game theory, cybernetics and so on. But I'm very interested in interrogating the differences here. The image of the world in enactment and reality becomes a blurry place. To transgress the possible, the probable, the fantastical and the real. Producing new realities, making new features of the world visible, and simultaneously obscuring and denying many other features of the social world. As a historian of science, I try to understand where these practices are similar. How can things be both homogenous in the strata of history, and ultimately diverse and plural?

HL: ... What we do in our lab is try to build better robots. Specifically, we try to build machines that are smart, machines that go beyond automation to become autonomous, make decisions and have feelings. In robotics, there is a forbidden word. We call it “the C word.” At the risk of blasphemy, I'll say it: consciousness. You will never see that word in any publication. We can't talk about it. But that's where we want to go. We want to build machines that are self-aware, machines that can make their own decisions. Through the hundred-year-old cybernetic movement—even with William Grey Walter's robots—the feelings that were attributed to machines that only had a couple of wires in them were amazing. We still do that today. We build crude machines and attribute all kinds of feelings to them. We're trying to create life like the alchemists a thousand years ago.

... Whether you call it consciousness, sentience or self-awareness, the way we look at it as engineers is the ability to imagine oneself. This is a very pragmatic, unromantic definition of self-awareness, but if you can imagine yourself walking on the beach tomorrow, near the Pacific Ocean—if you can feel the sand, if you can hear the water and if you can imagine something that you haven't actually experienced—you have the sort of self-awareness that we're trying to get to.

... Whenever I show this work, I encounter very interesting reactions. Most engineers will say, “Machines can never design as well as humans. Humans need to be in the loop.” Others will say this is a way to elevate designers to a point at which they just specify goals and critique solutions. They play around with building blocks and let AI become an assistant in the design process of generating solutions. Designers can just pick out what they want.
AJ: ... [02:59] The production of knowledge also has to do with certain devices: for instance, architecture. In our design for an elderly residency for Catholic priests, we decided to introduce devices that enabled people to measure certain realities. By measuring basic things like rainfall, they could participate in the making of many things and join in discussions in order to make them functional. I was very interested in the way Norgie Maris describes eco-homes as devices that promote the discussion of an ecological ethos among the people dwelling in them. Just as the remote control is a device that makes people discuss the switching of channels, we thought this could happen through undefined boundaries between pieces of garden assigned to each neighbor. The neighbors dealt with this as a kind of political ground. I love one photograph we took of the neighbors, because even though they look unhappy, it shows precisely the kind of social rendering that makes knowledge, and research, political.

AJ: ... [02:51] In another counterproject, my office documented examples of “ordinary urbanism” in the Lavapiés neighborhood of Madrid. We looked at a Mooride community. The males, often from Touba in Senegal, maximize their working capacity by moving to places like Madrid, Barcelona, Paris and London. There they can sell fake Louis Vuitton bags, among many other things, in the street. And they send money, mostly to women, people with disabilities and children remaining in Touba. Though we tend to think of things like digital calculability and parametrics as methods that belong to advanced architects, this community was constructed around calculability and certain kinds of parametric thinking that could mobilize unexpected infrastructures.

For instance, the men had to find a neighborhood they could navigate without the subway, where police detain illegal immigrants without much effort. They had to find a way to construct a neighborhood that could bring the Mouride men together. A mosque with front parlors, among other places, would allow them to buy and sell things. All this makes it possible to reduce the risk of operating in places like Paris or Madrid, and make it possible to send money to Touba.

I think this is very important. Knowledge, research and calculability are socially distributed. Access to power has to do with the capacity of a group to get organized, to produce knowledge, to measure certain realities, to recognize calculabilities and to operate with them; and to construct an urban form, even a performative one like this one.

Speakers:

Orit Halpern is an assistant professor in History at the New School for Social Research and Lang College. She is also an affiliate of the new Design MA in the Art and Design History and Theory School at Parsons. Her research is on histories of digital media, cybernetics, art and design. Dr. Halpern is author of Beautiful Data: A History of Vision
Andrés Jaque directs Andrés Jaque Architects and the Office for Political Innovation. The architecture office explores the potential of post-foundational politics and symmetrical approaches to the sociology of technology to rethink architectural practices. Jaque is currently Advanced Design Professor at Graduate School of Architecture, Planning and Preservation GSAPP Columbia University.

Hod Lipson is a Columbia University Professor and co-author of the award winning bestseller “Fabricated: The New World of 3D printing”. He is a frequent speaker at high-profile venues such as TED and the National Academies, and speaks on the future of technologies such as 3D printing, Robotics, and Artificial Intelligence.

Michael Sorkin is Principal of the Michael Sorkin Studio, President and founder of Terreform, Distinguished Professor of Architecture and Director of the Graduate Program in Urban Design at CCNY, and architecture critic for The Nation. In 2013, he won the National Design Award for “Design Mind.”

Organizers:

Esteban de Backer received degrees in architecture and environmental sciences from the School of Architecture in Barcelona and UGR, Spain. He worked at No.mad Architects as a Arquia Foundation fellow. As a recipient of the La Caixa Foundation fellowship, de Backer also earned a Master of Science in Architecture at Columbia GSAPP, where he completed the ARPA initiative. He currently works as an architect in New York City and serves as an adjunct faculty at the GSAPP.

David Isaac Hecht is a native of Brooklyn, NY. He has an M.Arch from Columbia GSAPP and a BA in Cognitive Science from Vassar College. David previously worked at the intersection of politics, finance, and philanthropy in New Jersey. He has been a studio TA at GSAPP, a researcher for the Temple Hoyne Buell Center for the Study of American Architecture, a Project Manager at Nodus in the Rockaways. He is currently conducting research for SO-IL in Brooklyn.

Alejandro Stein is an architectural designer and researcher based in New York City. He holds a Master of Architecture degree from Columbia University GSAPP, where he was awarded a Lowenfish Memorial Prize and an ARPA Research Fellowship. His research project conducted under ARPA, entitled Domesticity in the Office Landscape, investigates the potentials of converting the post-war, commercial skyscraper type for residential occupancy.

Mike Che-Wei Yeh is a designer and researcher of parametric design. He received his Master's of Science degree in Advanced Architectural Design from the Columbia University GSAPP, where he received the Lowenfish Memorial Prize. Yeh also earned his Bachelor's degree in Architecture from Tamkang University in Taiwan as a recipient of the Chi-Kun Wang Memorial Prize.

Moderators:

Janette Kim is an architectural designer, researcher and educator based in New York City. She is principal of All of the Above, a design practiced based in Brooklyn, and a faculty member at the Columbia University GSAPP, where she directs the Applied Research Practices in Architecture initiative and the Urban Landscape Lab.

Diana Martinez was the 2014-15 instructor for ARPA, she is a Ph.D. candidate in architectural history and theory at Columbia GSAPP. She has practiced as an architect in San Francisco, Manila and New York. Her research focuses on the role concrete and other industrial materials played in processes of colonization.

Leah Meisterlin is an urbanist, architect, and planner; a sociospatial data scientist, GIS methodologist, and cartographer. Currently, she is a cofounding partner and CEO at Office:MG and a term assistant professor of architecture at Barnard & Columbia. Her research is primarily focused on concurrent issues of spatial justice, informational ethics, and the effects of infrastructural networks on the construction of social and political space. Within this research and in practice, she specializes in human-centric design driven by data-based research methodologies.
Susanne Schindler is an architect and writer focused on the intersection of policy and design in housing. She is lead researcher of House Housing: An Untimely History of Architecture and Real Estate at Columbia's Buell Center and teaches design at Columbia and Parsons. She is a PhD candidate at ETH Zurich.