DRAWING CODES

Experimental Protocols of Architectural Representation

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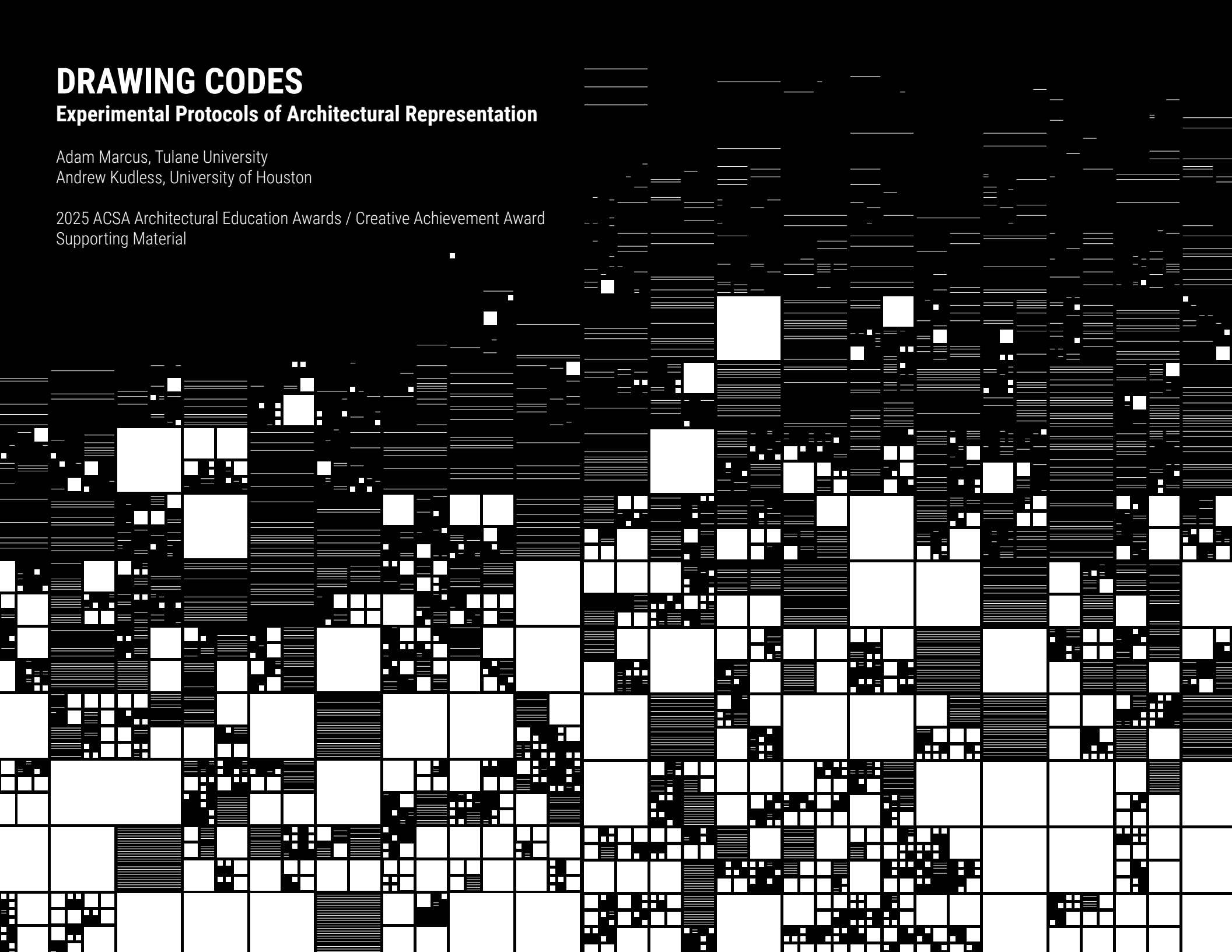
2025 ACSA Architectural Education Awards / Creative Achievement Award
Supporting Material

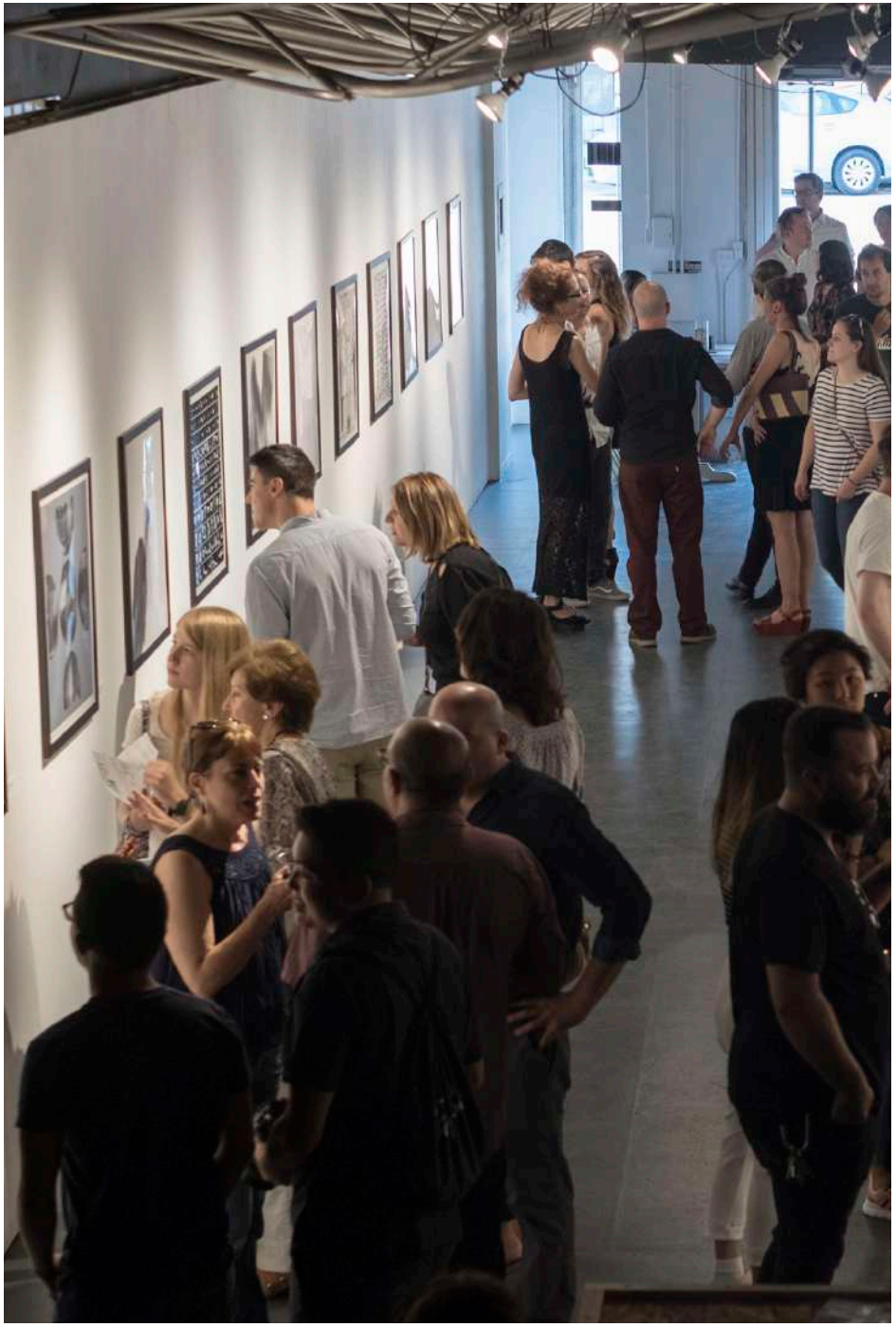


1. INTRODUCTION

Drawing Codes is a curatorial and research platform for investigating how emerging technologies of design and production have catalyzed new ways to engage with traditional practices of architectural drawing. The project, pursued through curation, scholarship, and workshops, blends research and teaching into a multi-year pedagogical project exploring the impact of computation on the discipline specifically through the relationship between code and drawing: how rules and constraints inform the ways architects document, analyze, represent, and design the built environment.

The project was initiated through a multivolume series of exhibitions that commissioned 96 experimental drawings from global contributors, representing a diverse cross section through the vanguard of contemporary practice. The first volume of the exhibition included 24 commissioned works and traveled to four venues from 2017-2018. The second volume of the exhibition expanded the archive with 24 new drawings and toured five venues from 2018-2021. The third volume of 48 drawings was commissioned for the compendium book (Applied Research + Design, 2024), which includes a new introductory essay by the curators situating the project within the broader histories of architectural representation and computational design, and as well as four critical invited essays by Ila Berman, Sarah Hearne, Amelyn Ng, and John McMorrough, reflecting on the broader implications of the project.

The project has catalyzed conversations across institutions about the impact of digital technologies on architectural representation in both practice and academic curricula. It has also catalyzed a series of experimental workshops working with students to test new computational workflows of representation. At a moment when automation increasingly suffuses contemporary life—and when one might assume that architecture's computational turn has diminished the importance of drawing to the discipline and to the profession—*Drawing Codes* reveals the opposite: a vital and enduring critical engagement with conventions of architectural representation as a fertile territory for invention and speculation.

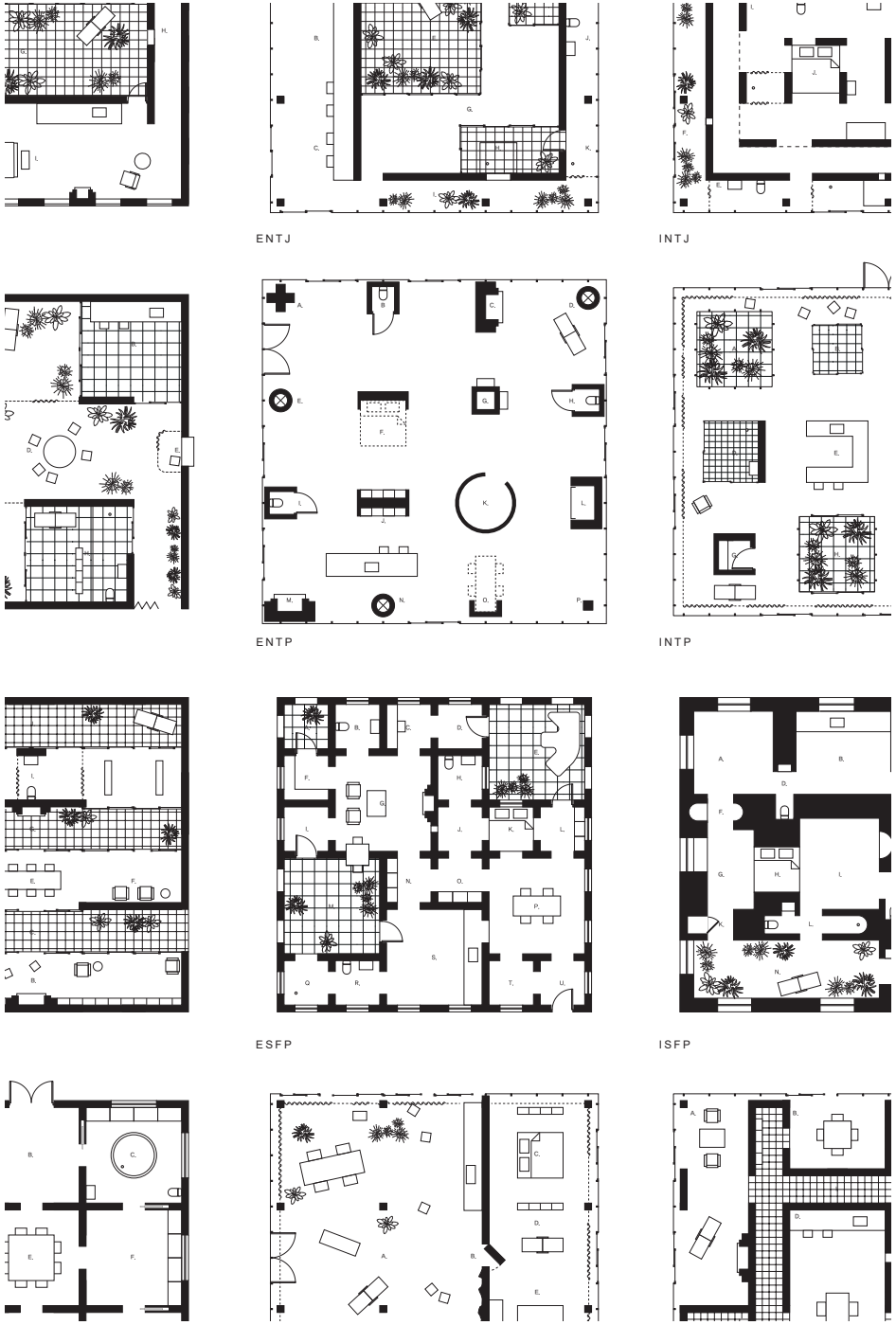


2. COMMISSIONED DRAWINGS: ARCHIVE AS ALGORITHM

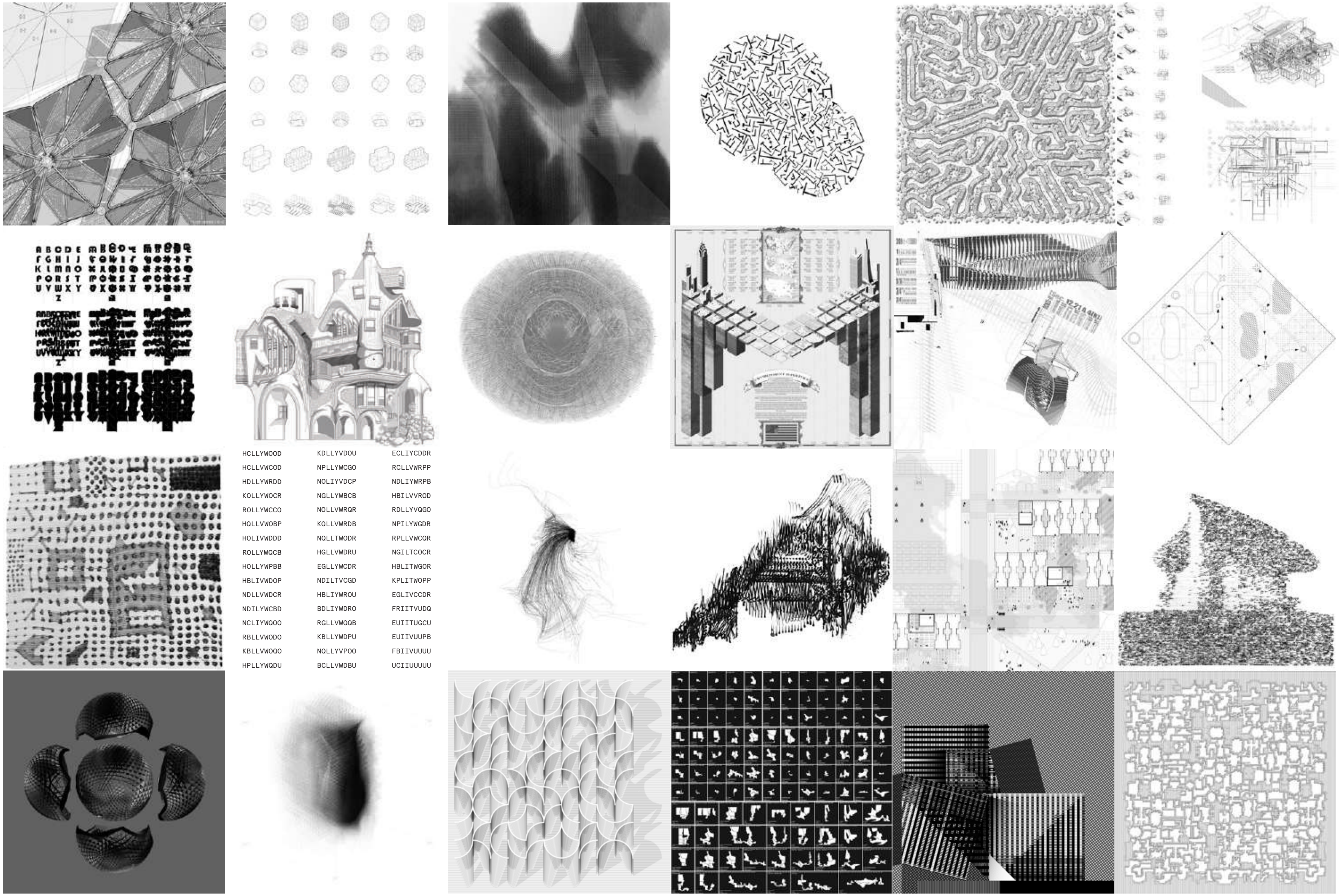
Drawing inspiration from computational and procedural logics, the *Drawing Codes* project itself is framed as a kind of algorithm. The brief invited contributors to make a drawing that responds to a series of prompts related to the definition of "code" in architecture, including code as generative constraint, code as language, code as cipher, and code as script. These prompts embraced an expanded definition of the term as a way to capture a more diverse understanding of how procedural and computational thinking is perceived and deployed by architects today.

In addition to the thematic prompts, contributors were asked to conform to a set of ground rules, or constraints, in dimension and format. The intent was to provide a degree of consistency, to allow difference to emerge as each contributor individually responded to the prompts. As with any generative algorithm, the initial code established a general set of conventions within which a wide variety of unpredictable and unexpected outcomes remains possible. By establishing a shared prompt and format for each of the drawings, we hoped to encourage contributors to be deliberate and intentional in their responses. Some contributors generated new work in response to the brief; others adapted existing or ongoing projects. Some remained observant of the constraints; others transgressed the rules in productive ways.

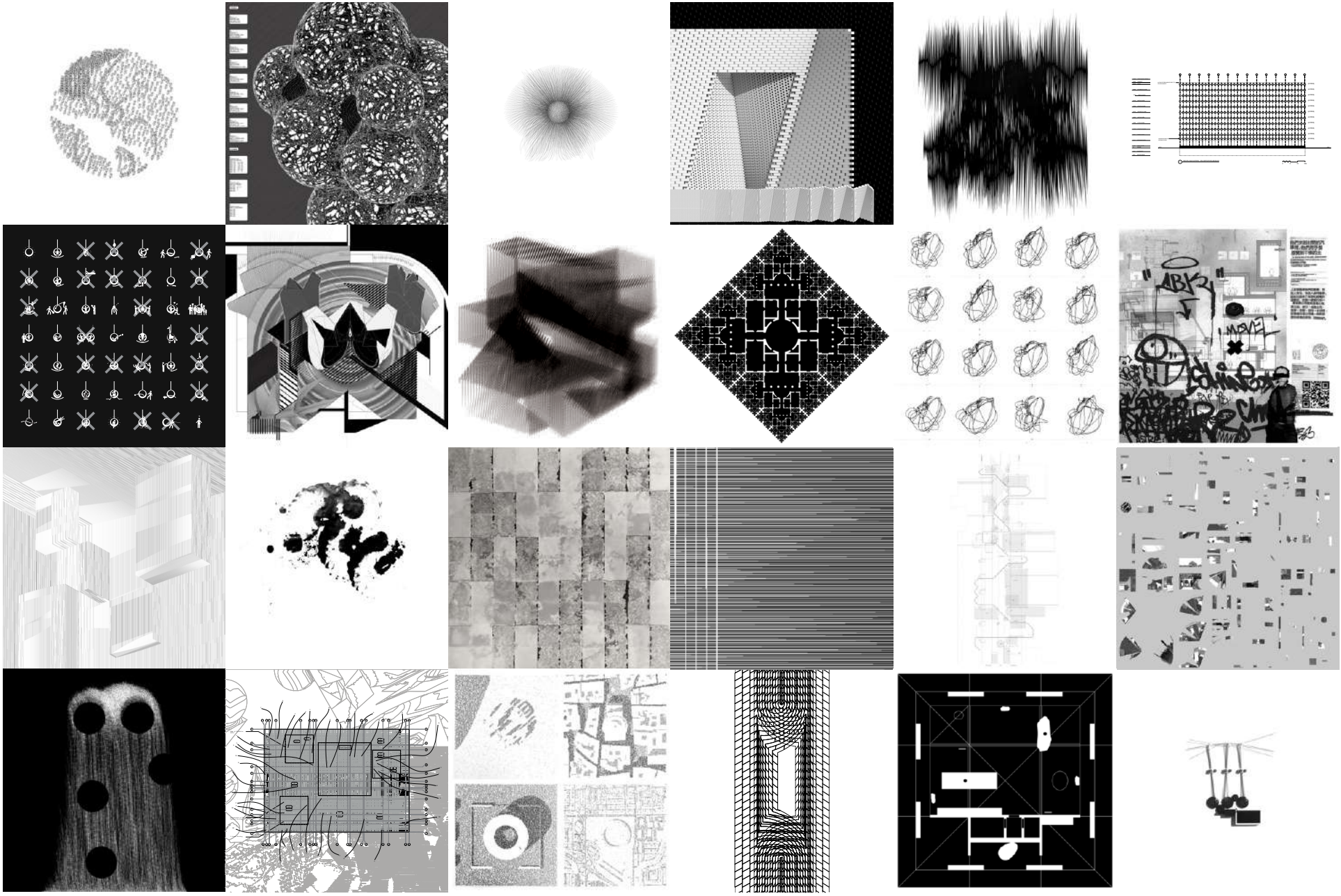
Within this considerable diversity of medium, aesthetic sensibility, and content, several commonalities emerge. First is the unsure link between code and outcome: glitches, bugs, accidents, anomalies, but also loopholes, deviations, variances, transgressions, and departures that open new potentials for architectural design and representation. Second is a mature embrace of digital technology not as a fetishized endgame, or as a set of push-button routines to be executed uncritically, but as a set of tools and workflows employed synthetically in concert with other architectural "tools of the trade." And finally, these drawings demonstrate how conventions of architectural representation remain fertile territory for invention and speculation. We have found that the exhibition has become a compelling platform for challenging the perceived homogeneity of computational thinking within the discipline of architecture; on the contrary, the project charts the discipline's diverse and rich range of approaches to computation and procedural design.



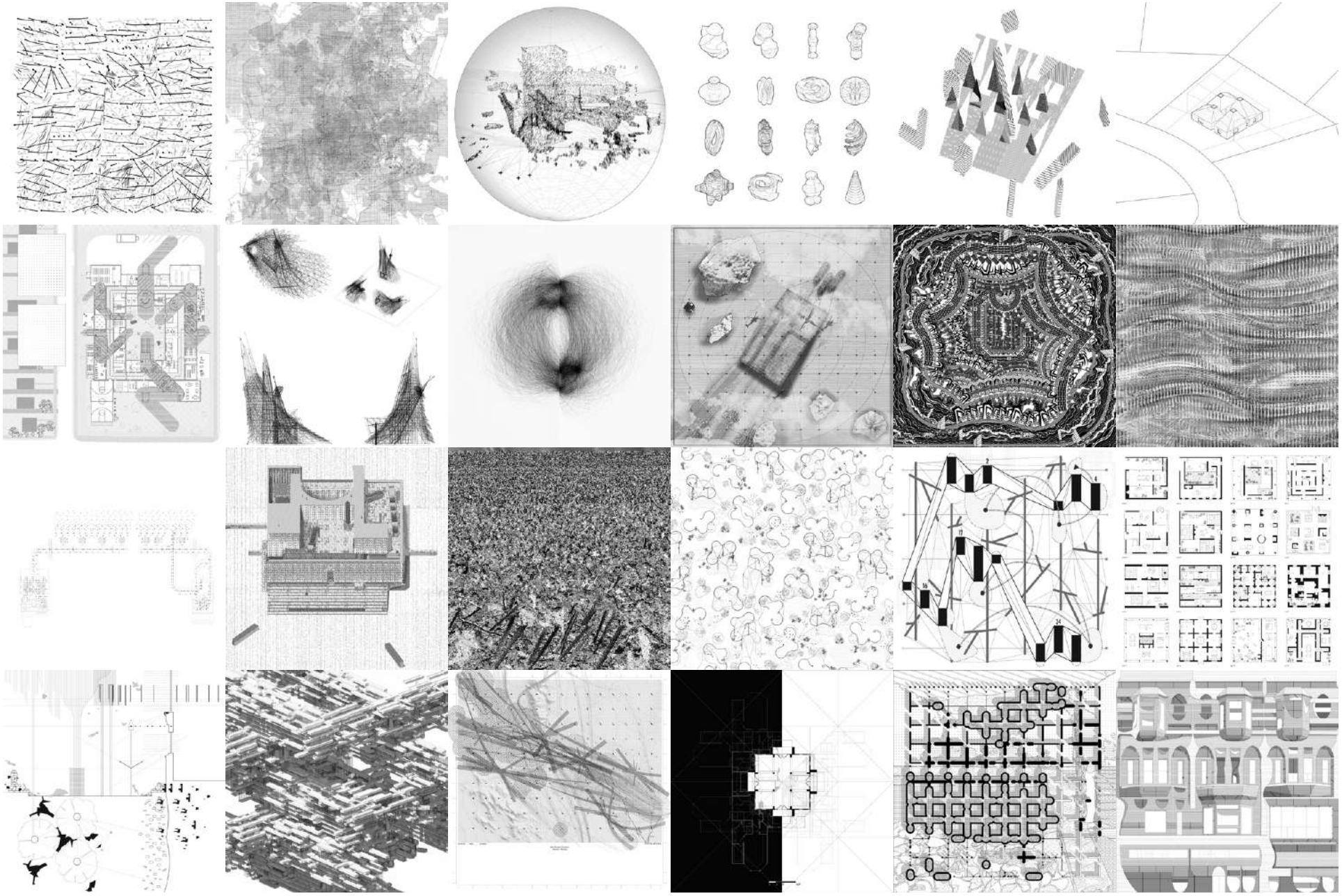
Detail, *A House for XXXX*
by Hyperspandrel / Jaewoo Chon



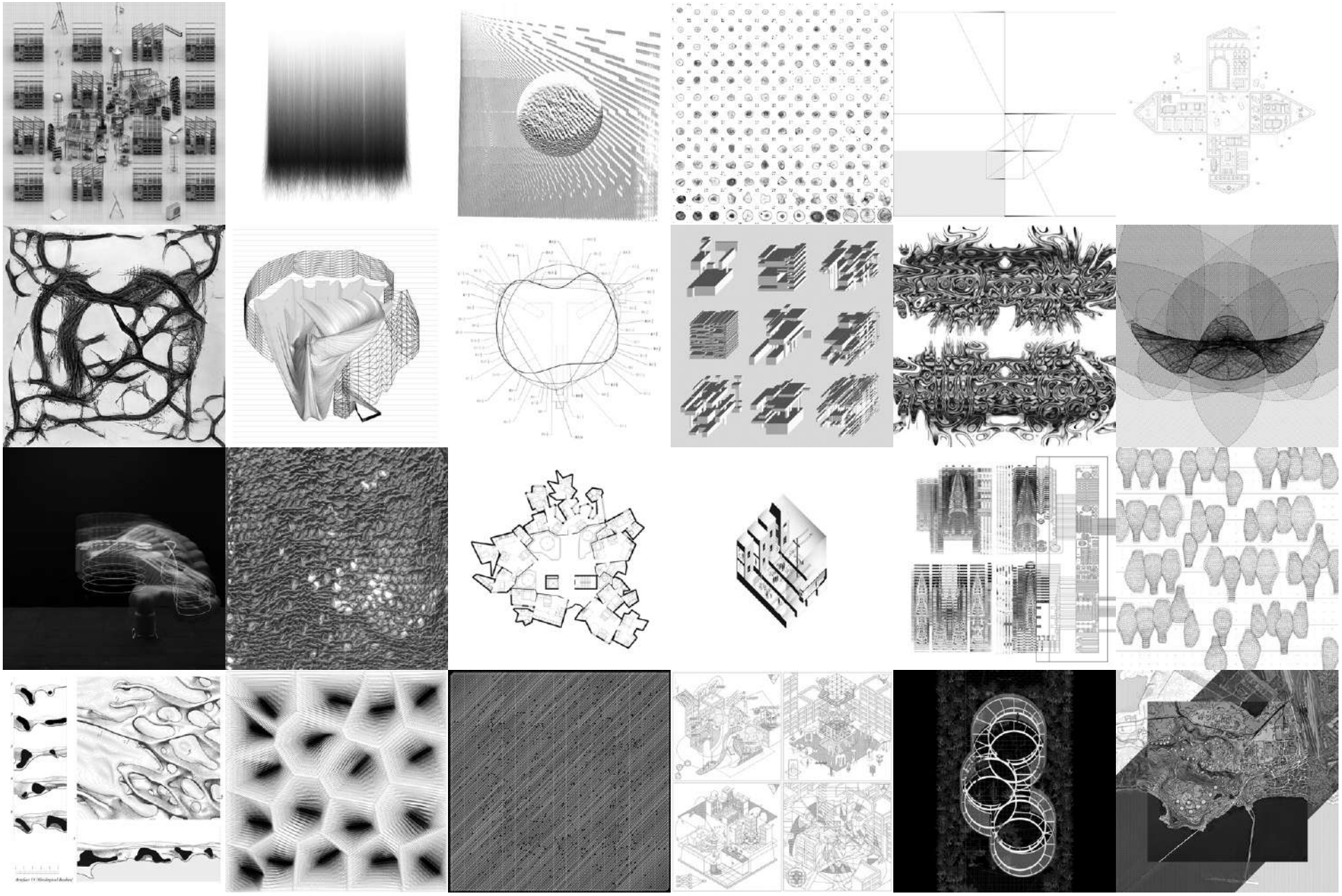
Volume I Contributors (left to right, top to bottom): FutureForms; Kristy Balliet; Curime Batliner; Andrew Kovacs; Andrew Kudless; Andrew Heumann; Kelly Bair; Clark Thenhaus; Mark Ericson; Neeraj Bhatia / The Open Workshop; Oyler Wu Collaborative; Jimenez Lai; Amy Campos; David Gissen; Joris Komen; Erin Besler; Janette Kim; Ron Rael and Virginia San Fratello; Heather Flood; Viola Ago; Adam Marcus / Variable Projects; FAULDERS STUDIO; Elena Manferdini; Young Ayata



Volume II Contributors (left to right, top to bottom): Aranda\Lasch; MARC FORNES / THEVERYMANY; Madeline Gannon / ATONATON; Nader Tehrani & Matthew Waxman; Catie Newell / Alibi Studio; Tsz Yan Ng, with Mehrdad Hadighi; Höweler + Yoon; Ibañez Kim; IwamotoScott Architecture; Outpost Office; Heather Roberge / murmur; John Szot; Stephanie Lin; V. Mitch McEwen; Emma Mendel & Bradley Cantrell; Jenny E. Sabin / Jenny Sabin Studio; SPORTS; T+E+A+M; Michael Meredith & Hilary Sample / MOS; MILLIØNS (Zeina Koreitem + John May); modem (Kathryn Moll & Nicholas de Monchaux); Studio Sean Canty; WOJR; Maria Yablonina



Volume III Contributors (left to right, top to bottom): AD-WO; Daisy Ames; A/P Practice; Germane Barnes; Jennifer Bonner; Andrew Bruno; EXTENTS; Chris Cornelius; Edouard Cabay; DESIGN EARTH; Drawing Architecture Studio; Dana Cupkova; Liz Galvez; Kevin Hirth; Home Office; HABITABLE Studio; Andres L. Hernandez; Jaewoo Chon; Joyce Hwang; Daniel Koehler and Rasa Navasaityte; Ersela Kripa and Stephen Mueller; Keith Krumwiede; Hyojin Kwon; LAMAS



Volume III Contributors (left to right, top to bottom): Li Leyuan; LOJO; Carl Lostritto; After Architecture; Ajay Manthripagada; Architecture Office; Alicia Nahmad Vazquez; Vernelle A.A. Noel; Norman Kelley; office ca; Curtis Roth; Synthesis Design + Architecture; Stefana Parascho; Mariana Popescu; John Porral; Ultrabarrio; Zahra Safaverdi; SCHAUM/SHIEH; SNOOKS + HARPER; transLAB; Jenny Sabin; You + Pea; Z4A/Z4Z4; Bz Zhang

3. TRAVELING EXHIBITION

The first two volumes of the exhibition have traveled to nine venues nationally, and two installations of Volume III are planned for 2025 to mark the launch of the *Drawing Codes* book. The venues are all galleries housed within schools of architecture, foregrounding the project's emphasis on and relevance to conversations about architectural pedagogy. While the uniform format of the work provides consistency from one exhibition to the next, each iteration of the show has experimented with different installation strategies inspired by unique qualities of the respective gallery space.

VOLUME I:
California College of the Arts, San Francisco CA / Jan. – Feb., 2017
WUHO Gallery, Los Angeles CA / Jul. – Aug., 2017
Knowlton School of Architecture, Columbus OH / Jan. – Feb., 2018
University of Michigan Taubman College, Ann Arbor MI / Mar., 2018

VOLUME II:
Houghton Gallery, The Cooper Union, New York NY / Jan. – Feb., 2019
University of Virginia School of Architecture, Charlottesville VA / Mar. – Apr., 2019
University of Miami School of Architecture, Miami FL / Aug. – Oct., 2019
Univ. of Washington College of Built Environments, Seattle WA / Feb. – Mar., 2020
California College of the Arts, San Francisco CA / Sep. – Oct., 2021

VOLUME III (forthcoming):
University of Houston, Houston TX / Jan. – Mar., 2025
Tulane University, New Orleans LA / Mar. – May, 2025

Installation of Volume II at the Hubbell Street Galleries, California College of the Arts, San Francisco, CA, 2021 (Photograph: Nicholas Bruno)

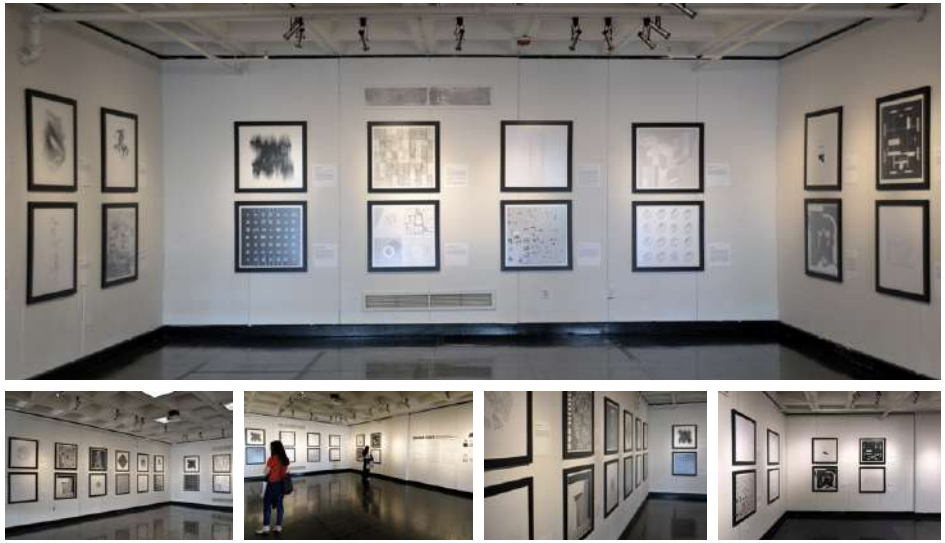
Installation of Volume I at Hubbell Street Galleries, San Francisco, CA, 2017

Installation of Volume I at WUHO Gallery, Los Angeles, CA, 2017

Installation of Volume I at Banvard Gallery, Knowlton School of Architecture, Ohio State University, Columbus, OH, 2018

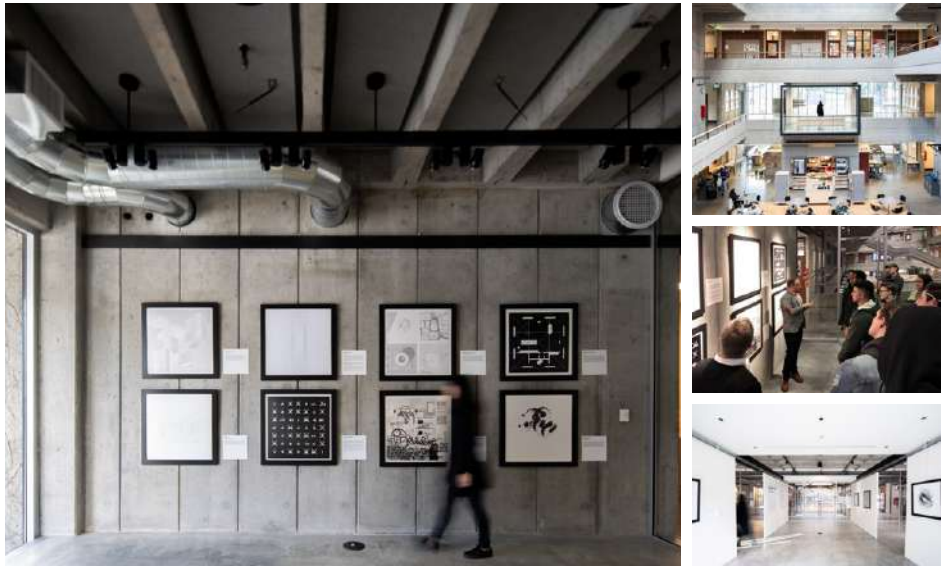
Installation of Volume I at Taubman College, University of Michigan, Ann Arbor, MI, 2018

Installation of Volume II at the Arthur A. Houghton, Jr. Gallery, The Cooper Union, New York, NY, 2019 (Photographs: Photographs by Lia Bertucci / The Cooper Union, Irwin S. Chanin School of Architecture)



Installation of Volume II at Elmaleh Gallery, University of Virginia School of Architecture, Charlottesville, VA, 2019 (Photographs: Photographs by Tom Daly and UVA School of Architecture)

Installation of Volume II at the Korach Gallery, University of Miami School of Architecture, Miami, FL, 2019

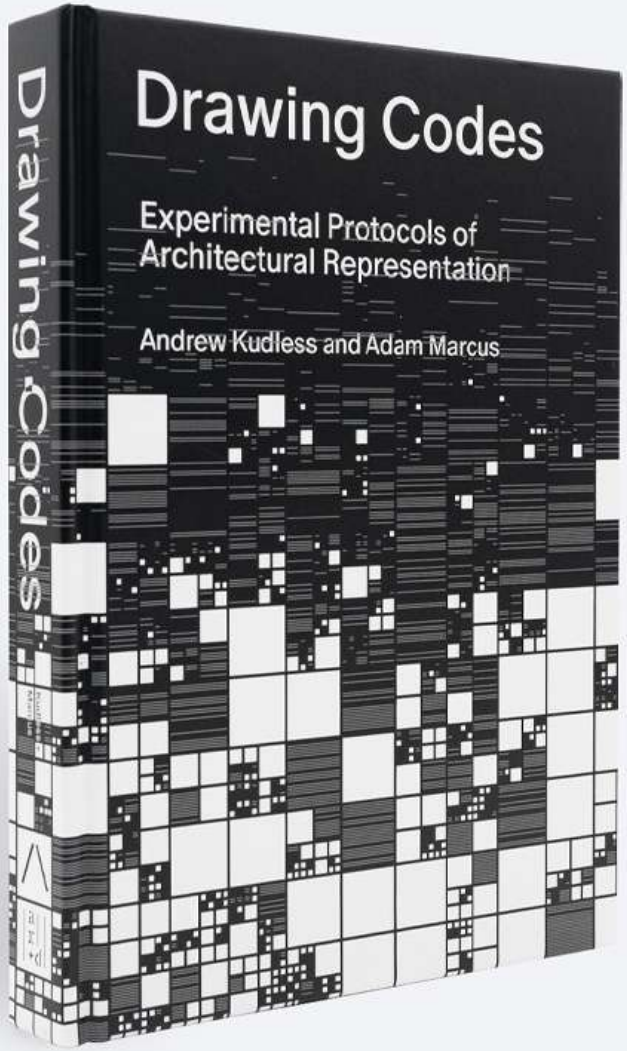


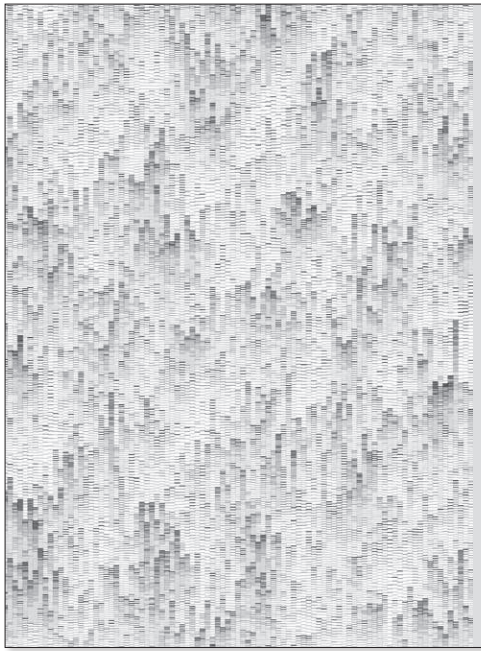
Installation of Volume II at the Gould Gallery, University of Washington College of Built Environments, Seattle, WA, 2020 (Photographs: Vlanka Catalan)

4. COMPENDIUM BOOK (APPLIED RESEARCH + DESIGN, 2024)

The publication of the *Drawing Codes* book in October 2024 documents the work commissioned and collected for the seven-year project. The 96 drawings are organized into eight sections according to emerging themes, workflows, and sensibilities in the ways contributors interpret the relationship between architectural drawing and code.

The book also includes six new essays reflecting on the implications and impact of the project. The introductory essay by Kudless and Marcus discusses the premise of the overall project, positioning it within broader histories of architectural representation and procedural design. Ila Berman's essay "Deciphering Drawing" offers a broad and thorough survey of the drawing archive and situates this work within the broader evolution of architectural representation in the wake of Modernism. "Leaving the Page" by Sarah Hearne presents a "microhistory" of an early experimental film project by Peter Eisenman as a salient precursor to the discipline's engagement with process, iteration, and automation that underlies much of the *Drawing Codes* project. "Scanning, Storing, Checking: Architecture and the (Machine-Readable) Image" by Amelyn Ng positions this project in a broader context of imaging technologies, raising important questions about authorship, subjectivity, and labor in the production of architectural knowledge. The end of the book includes John McMorrough's essay "Ends of Drawing," an afterword that ruminates on the word "drawing" and its multiple meanings and modalities. And finally, Kudless and Marcus conclude with a short Coda reflecting on this experiment and its implications for architectural design.





Drawing after Computation

Andrew Kudless and Adam Marcus

A history of architecture that dealt with the impact of drawing would need to explain two things: how architectural spaces arose out of the deployment of depthless designs, and how architectural space was drawn into depthless designs.

— Robin Evans, *The Projective Cast* [1]

The relationship between drawing and architecture is foundational yet paradoxical. As Robin Evans suggests, architecture can be defined by the struggle between the inherently two-dimensional plane of the drawing and the three-dimensional reality of space. Architects must fold the complexities of construction, materiality, and perspectival view into flat drawings while at the same time unfolding the abstract rationality of the drawing back into built form.[2]

This tension between the abstract and the real was codified in Leon Battista Alberti's fifteenth-century text *De Re Aedificatoria*, in which the architect's role as designer is established as separate and distinct from the role of the builder.[3] Following Alberti, the architectural drawing remained primarily a communicative device: it simply conveys instructions for others to fabricate and construct a building. Over the next few hundred years, architectural drawing made great progress, enabled by new drawing techniques and their dissemination through new media technologies. From the wide distribution of Giovanni Battista Piranesi's prints to Gaspard Monge's development of the mathematics of descriptive geometry, architects learned how to communicate their designs with both more realism through rendered perspectives as well as more dimensional accuracy in plans, sections, and elevations. However, a disciplinary schism slowly developed, foreshadowing Evans's dichotomy between the abstraction of "depthless designs" and the reality of architectural space. Was drawing's primary role to communicate the functional and analytic information of dimensions, proportions, and constructability, or was it to communicate a prospective and evocative simulation of reality?

1 Robin Evans, *The Projective Cast: Architecture and its Three Geometries* (Cambridge, MA: MIT Press, 1995), 1.

2 This essay expands upon a paper previously published by the authors, documenting the first volume of the *Drawing Codes* exhibition. See Adam Marcus and Andrew Kudless, "Drawing Codes: Experimental Protocols of Architectural Representation," in *Recalibration: On Imprecision and Infidelity: Proceedings of the 38th Annual Conference of the Association for Computer Aided Design in Architecture*, ed. Phillip Anzalone, Marcella del Signore, and Andrew John Wit (n.p.: ACADIA, 2018).

3 Leon Battista Alberti, *De Re Aedificatoria / On the Art of Building in Ten Books*, trans. Joseph Rykwert, Robert Tavernor, and Neil Leach (Cambridge, MA: MIT Press, 1988).

Fig.1
Andrew Kudless, *Non-Square Pixels*, 2020. This project samples input images into a series of vector-based irregular "pixels." Instead of the square grid of pixels found in the source image, the image is divided into irregular fields whose centroid is then used for the color of the region. Although we have become accustomed to viewing blurry low-resolution images, these drawings are simultaneously low resolution and highly defined.

Drawing Conclusions

Although prompted by a prescriptive and focused brief asking contributors to interrogate the relationship between architectural drawing and code-based processes, the *Drawing Codes* project has yielded a remarkably broad and diverse range of responses. Within this considerable diversity of medium, aesthetic sensibility, and content, several commonalities emerge. First is the unsure link between code and outcome: glitches, bugs, accidents, anomalies, but also loopholes, deviations, variances, transgressions, and departures that open new potentials for architectural design and representation. Second is a mature embrace of digital technology not as a fetishized endgame, or as a set of push-button routines to be executed uncritically, but as a set of tools and workflows employed synthetically in concert with other architectural "tools of the trade." And finally, for those who have wondered if architecture's computational turn has diminished the importance of drawing to the discipline and to the profession, this work reveals the opposite: a vital and enduring critical engagement with conventions of architectural representation as a fertile territory for invention and speculation.

Deciphering Drawing

Ila Berman

Drawing, that is, the marking of a two-dimensional surface with lines, is older than written forms of language, dating back tens of thousands of years to cave drawings and petroglyphs. In its pre-digital form, drawing was an act involving the hand and body, eyes and mind. It was grounded in both optical perception and haptic experience, initially a gesture, no matter how precise the skill of moving the hand or how controlled the regime of mechanical devices used to guide it. Defined in this way, drawing was therefore governed by what semiologists would classify as the index, whereby the line in its most fundamental form, whatever its secondary capacity for representation or figuration, is the result and signifier of an actual act. It is therefore motivated by and dependent upon the hand moving in space, and the transfer of material from one object—the graphite of the pencil or the ink of the pen—onto a two-dimensional surface, whether paper or vellum, parchment or rock.

Architectural drawing, as a subset of drawing in general, has its own specific history, certainly much younger than that of drawing itself. In its capacity as an agent of architectural design, drawing is a form of emergent proto-architecture, always operating in the virtual realm that precedes the making of buildings where speculation, creativity, and innovation reside. As the design process evolves toward the object it anticipates, architectural drawings begin to concretize, not only around the communicative and iconic conventions of its drawing practices—plans, sections, and elevations that operate as codified representations of architecture—but also around the fixity of the building this process is intended to both describe and realize. Unlike language, however, which is based on an arbitrary and fixed relationship between the graphic and sonorous elements of signs and their referents in the world, architectural drawing is heavily dependent on formal similitude, which is what enables its transformation and eventual evolution over time. Yet, as a product of convention, one that Anthony Vidler defines as a form of clandestine trade knowledge that is "as potentially hermetic to the outsider as a musical score or a mathematical formula,"[1] the codification of architectural drawing, from its use of symbols and notation to its

1 Anthony Vidler, "Diagrams of Diagrams: Architectural Abstraction and Modern Representation," *Representations*, no. 72 (2000): 1.

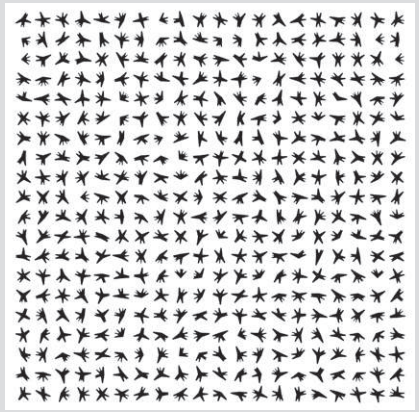


Fig.2
Adam Marcus, *Radial Figures, Seed 833*, 2016. This series of drawings explores the overlap between procedural, computational design processes and conventional techniques of architectural representation. The two-dimensional figures are generated by an initial rule set determined by the designer, yet the process relies on random seeds to produce a field of variations.

computation's agency to generate drawings without models, thereby recapturing the generative capacity of architectural representation. By foregrounding the importance of code—procedural, algorithmic, and rule-based processes—the archive of drawings included in this book begins to suggest new forms of agency and possibility for the architectural drawing in the computational era.

Drawn Apart

The *Drawing Codes* project was instigated not only by an interest in the agency of computational *drawing*, but also by a larger frustration with prevailing paradigms of computational *design* in architecture. In contemporary practice and academia alike, computational approaches to design are often now associated with stylistic tropes of continuous differentiation, panelized surfaces, twisted towers, and the like. This tendency is perhaps best formalized in Patrik Schumacher's notion of "Parametricism," in which he calls for "a maximal emphasis on conspicuous differentiation."[9] In many regards, this alignment between technique and stylistic outcome that Schumacher called for has now been firmly cemented; this is immediately evident in a simple Google Images search for "parametric design" or "digital fabrication," which reveals how the initial novelty of computational form-making has become mainstream within the last decade.

Although Schumacher acknowledges that computational tools can be used to create non-Parametricist designs, he discounts this as a Modernist resistance to complexity: "This is evidenced by the fact that late Modernist architects are employing parametric tools in ways which result in the maintenance of a Modernist aesthetics, i.e. using parametric modeling to inconspicuously absorb complexity."[10] However, this presents a false dichotomy, as one must seemingly choose to adopt Parametricism as style or remain a Modernist misusing computational tools.

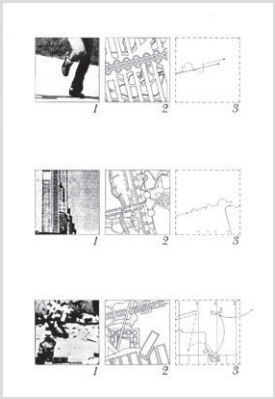
This conundrum also resonates in the academy, as schools of architecture struggle to teach computational tools in a critical manner. The stylistic trap outlined above drives a vicious circle: students too often think that the only application for these tools is to create twisted towers or complex panelized surfaces, and that computational thinking has no other purpose within the architectural design process. This represents a failure of pedagogy, as students (and often faculty) equate a set of tools with a specific type of architecture.

The *Drawing Codes* project recognizes that current teaching practices may be unintentionally supporting this perception, and that perhaps architectural drawing might present one avenue for situating computation within the discipline of architecture in a more comprehensive and critical way. This book seeks to challenge the easy association of specific toolsets and processes with stylistic tropes as unproductive, in that it forecloses broader conversations, such as how computational workflows relate to historical precedent, or how they can have transformative impact on architecture beyond a certain visual

9 Patrik Schumacher, "Parametricism as Style—Parametricist Manifesto" (presented and discussed at the Dark Side Club, 11th Architecture Biennale, Venice 2008), accessed May 16, 2023, http://www.patrikschumacher.com/Texts/Parametricism%20as%20Style.htm.

10 Patrik Schumacher, "Parametricism as Style—Parametricist Manifesto."

Fig.1
Bernard Tschumi, *The Manhattan Transcripts*, 1976–1981.



iconic methods of representing form, renders it akin to a relatively fixed communicative system and therefore resistant, at least in principle, to the very inventiveness of the design process that precedes its use in the production of buildings. Although architects almost "never work directly with the object of their thought, always working at it through some intervening medium," which Robin Evans claims puts them at a clear disadvantage in relation to other art forms,[2] the architectural drawing, as a para-architectural object marginalized with respect to architectural practice, is also what enables it to be a site of intense experimentation when its tools, techniques, and methodologies are intentionally unleashed from their instrumentalization. When seen not simply as a means to an end, a byproduct of a process territorialized by the identity of the built work that it ushered into being, the re-centered drawing, as evidenced by the collection of works presented in *Drawing Codes*, facilitates its reconception as the locus, rather than the periphery, of architectural thought and practice, design and representation. This notion of the architectural drawing as a self-sufficient conveyer of ideas, whether its referents are internal or external to the project or discipline, has a long tradition within architecture. The last half-century alone witnessed the proliferation of architectural drawings deemed to be autonomous objects in their own right, exemplified by Archigram's provocative pop-inspired neo-futurist drawings of their *Walking City*, *Plug-in City*, and *Instant City*, Bernard Tschumi's filmic and notationally choreographed *Manhattan Transcripts*, Daniel Libeskind's *Micromegas* and *Chamberworks* series, John Hedjuk's architectural characters populating his masques, and practically the entirety of Peter Eisenman's architectural oeuvre, often criticized for being more about the drawings of the formative process than about architecture's built material reality.

Notwithstanding the intrinsic codification of architectural drawing and the subtle reference to this in the title of this book and the work to which it refers, the hybrid term *Drawing Codes* is an unlikely pairing given the historic chasm between drawing and computation. Whereas the former traditionally involved the manipulation of material and an embodied choreography of the eye and hand, paper and ink, the latter was governed by a disembodied optical interface—the pixelated computer screen—supported by mathematical algorithms and an immaterial numerical sequence of zeros and ones. As computers began to be assimilated into architecture and as the profession and discipline became computerized, the displacement of drawing by computation led to the suppression of hand drawing within both practice and the academy: first, through the conscious abandonment of the traditional implements used to draw—pencils and mechanical pens, T-squares and Maylines, compasses and adjustable triangles, trace paper and vellum—and second, by the evolving erasure of its pedagogy. The "paperless studio," made manifest by the replacement of drawing with digital tools, embarked upon by Greg Lynn, Hani Rashid, Stan Allen, and others under Bernard Tschumi's deanship at Columbia University in the mid-1990s, was a clear indicator of what was to become our architectural future, a pedagogical shift that, not surprisingly, occurred in concert with the disuse of the term "drawing" itself. This was not only because of the

2 Robin Evans, "Translations from Drawing to Building" in *Translations from Drawing to Building and Other Essays* (Cambridge, MA: MIT Press, 1997), 156.

Selected essay spreads from the book.

encompasses the project of the exhibition itself, where a set of rules coheres in a multitude of approaches to monotone prints, on paper and printed. There is a curious paradox at play in all this decision-making, in the insistence on code and process, and in the very dilemma that printing on paper, rather than opening a file on a screen, obfuscates the very technical procedures behind these works.

Scanning, Storing, Checking: Architecture and the (Machine-Readable) Image

Amelyn Ng

0. Start

In *Signal. Image. Architecture.*, John May makes an acute if banal observation about architectural representation: in software, designers are fundamentally no longer drawing, but imaging. Architecture is now produced in a world where databases regulate geometry and photogrammetry succeeds photography—and in this world, an image no longer merely depicts form, but crucially allows computers to *read and write* form as data, and *extract* data from form.[1] To *image* today is to wrest pseudo-orthographic views (Make2D) from three-dimensional (3D) objects, or to axonometrically "explode" a Revit model (Displaced Views) with no destructive effect on its integrated whole. To image is to automate drawing procedures, to generate reversible options, to edit form from lines of code, to scan something into a million pieces and reassemble it as photorealistic mesh. The banality of these techniques shows just how deeply architectural practice has come to rely on the machine-readable image. Drawings, if we can still call them that, have become the stuff of telematic data, whose visuality is contingent upon computer processing.

What does imaging mean in an era of informatics? May's observation is not confined to architecture: engineering, construction, planning, and even the global logistics industries have put aside orthographic drawings for data-based images, embracing "numbers grafted to matter" that can be networked, mined, and optimized for organizational insights.[2] It is in this vein that images not only represent, but also tag, track, and proxy physical environs. This essay ruminates on the politics, materialities, and digital labors of machine-readable images and explores how certain acts of imaging have restructured—and have, in turn, been complicated by—architectural representation. I will focus on three simple yet ubiquitous techniques: *scanning* (drawing as a capture

1 "What happens to the architectural mind when it stops pretending that images are drawings? When it finally admits that imaging is not drawing, but is instead something that has already obliterated drawing? What happens when it stops pretending that databases are the same as geometric objects?" John May, "Telematic," in *Signal. Image. Architecture.* (New York: Columbia Books on Architecture and the City, 2019), 101.

2 In Ned Rossiter's media theory of logistical infrastructure, "numbers [are] grafted to matter. … [But numbers] don't always stick. In the case of the logistical fantasy of seamless interoperability across global supply chains, numerous conflicts emerge at the level of protocols, sabotage, labor disputes, excess inventory, and so forth." Ned Rossiter, *Software, Infrastructure, Labor: A Media Theory of Logistical Nightmares* (New York: Routledge, 2016), 27. See also Amelyn Ng, "From Models to Mirror Worlds," *Cultural Politics* 18, no. 3 (2022): 297–311.

biomaterial building project, expands this representational lineage and its emphasis on variant multiples and their transformations.

Drawings related to the logics of fabrication and assembly point to the complexity of both architecture and the architectural process, given that each drawing, akin to the elements to which it refers, is always both part and whole, simultaneously an elemental part, component, or fragment of some larger whole, while also constituting an autonomous object in its own right. Each drawing is also a single constituent of a much larger multiplicity of representations, notations, and encoded diagrams that describe the conceptualization, design, modeling, programming, building, or perceptual experience of a single artifact. If architectural drawing before computation had already signified the iterative and endless array of distinct materializations of this process as well as the many types of representations that these include, all part of the "work" of architecture in excess of the singularity of the building, the 96 drawings generated for *Drawing Codes* are a testament to the expanded impact and complexity of architectural drawing brought about by its intersection with computational tools and methodologies. Akin to the generative work of the diagram, all of these drawings are productive hybrids of their own, virtual experimental abstractions that mine the endless potential interactions of matter and code, bringing together new materials, protocols, and contents with the deterritorialized residue of architecture's previously encoded formations. A clear indicator that the digital revolution did not eradicate architectural drawing[9] (or the highly personalized and distinctly authored modes of design expression it embodied, as evident in the range of idiolects in this book) but rather contributed to its augmentation and evolution, *Drawing Codes* brings drawing back into the center of architectural thought and practice, offering a highly creative set of prompts and classification strategies to expose this wide-ranging and highly heterogeneous milieu that constitutes architectural drawing today while radically expanding the codes and conventions from which they were born.

9 The question of whether the architectural drawing is dead as a result of an increasingly computerized design culture has been speculated upon by many, including at the symposium "Is Drawing Dead?" held at Yale in 2012.

Leaving the Page

Sarah Hearne

Much of the attention from the past 20 years of media archeology in our field has been spent examining the myths of the "paperless" studio, the office, and by now, the gallery. The possibilities of such a condition of production coalesced around the promises of computation. Even before computers were widely incorporated into architectural working spaces, they had transformed both the design process and the act of drawing. The variety of approaches we see in the expanded database of *Drawing Codes* reflects the immediate history of this shifting around the notion of design process and processing. Despite a curatorial premise that on the one hand defined a standard dimension and on the other allowed freedom of support medium, the responses were overwhelmingly printed as drawings on paper. While it might be tempting to read an exhibition of drawings as a pragmatic decision for a traveling show—drawings are easily mailed in a tube or delivered as compressed files—perhaps we should consider something else that keeps us on the page in our contemporary moment. The attachment to drawings printed on paper in the exhibition, as it turns out, is somewhat intrinsic to several immediate histories of process in architecture. The printed page became the stage on which architects played out fantasies of new energetic models for architecture, moving toward a visualization of thinking, and even the possibility of "mining" intuition as a resource for design.

Drawings transformed during the 1970s just as it became increasingly unclear what a design process was, who took part in it, and how it was to be divided and defined.[1] Paul Rudolph—an architect as famed for his hatched renderings as for his hammered-concrete buildings[2]—wrote in an introduction to *Drawings by American Architects* in 1973:

> The age-old process has not changed much. The *idea*, transmitted to the *sketch* often augmented by *models* is developed into a *rendering*, which is in turn *translated* into *working drawings*. These evolve into a *building*.[3]

What Rudolph so casually outlined was two seemingly enduring facts about architecture: that representations

1 For a good example of this narrative, see the passage on "The Process of Design" in Eve Blau, Edward Kaufman, Robin Evans, and Centre canadien d'architecture, eds., *Architecture and Its Image: Four Centuries of Architectural Representation: Works from the Collection of the Canadian Centre for Architecture*, Canadian Centre for Architecture (Montreal: Canadian Centre for Architecture ; Montreal: Canadian Centre for Architecture / Centre Canadien d'Architecture, 1989), distributed by MIT Press), 305.

2 Timothy M. Rohan has connected the signature hammered concrete used by Rudolph in 1963 in the Yale Architecture Building as an effect produced out of his rendering's hatch work in "Rendering the Surface: Paul Rudolph's Art and Architecture Building at Yale," *Grey Room*, no. 1 (Autumn 2001): 84–107.

3 Paul Rudolph, introduction to Alfred M. Kemper, *Drawings by American Architects* (New York: J. Wiley & Sons, 1973). Italics in the original.

building. Peering through layers of historically preserved architectural surfaces, one just makes out the ghostly traces of maintenance and renovations past. Yet this unconventional surveying method does not attempt to culminate in a scientifically verifiable whole, but rather, "asks how building value is produced through instruments of expertise," and identifies how "scientific methods attempt to produce stable notions of history and value," through the act of imaging itself.[20]

20 See Caitlin Blanchfield and Farzin Lotfi-Jam, *Modern Management Methods: Architecture, Historical Value, and the Electromagnetic Image* (New York: Columbia Books on Architecture and the City, 2019).

II. Storing: Drawing as Telematic Database

Scanning aside, the act of storing has also become essential to imaging practice. Storage enables drawings and models to maintain real-time relationships with each other (think linked models and families, XREFs, InDesign links folders, GIS geodatabases). Beyond architecture, the storage of physical things in warehouses and at shipping terminals relies on telematics and enterprise

Fig. 6
Caitlin Blanchfield and Farzin Lotfi-Jam, *Modern Management Methods*: "X-ray of a fire and smoke sealing door in the hallway between the General Assembly Building and Conference Building of the United Nations."

resource-planning software to track products and manage on-demand supply chains. Soenke Zehle and Ned Rossiter, referencing Walmart's use of big data to streamline its operations, make it clear that data storage is a site of infrastructural power: "Walmart is a data company. Logistics determine where the humans move. That's where all the power is."[21] So let's be clear from the outset: the database form is biopolitical, in Foucault's sense of statistical governmentality. At the urban and infrastructural scale, "smart city" proposals require algorithmic reach into homes and streets through networked databases. Shannon Mattern, Shoshanna Zuboff, and Orit Halpern et al. have in recent years provided scholarly critique on the entanglements between smartness, data extractionism, and governance by dashboard.[22] Sensor-laden domestic interiors and public spaces surveil their subjects as data points while continuously extracting physical information to feed analytical and predictive models. "Smart" systems presume 24/7/365 data storage, which presumes constant data collection, which produces a statistical (and logistical) way of seeing.

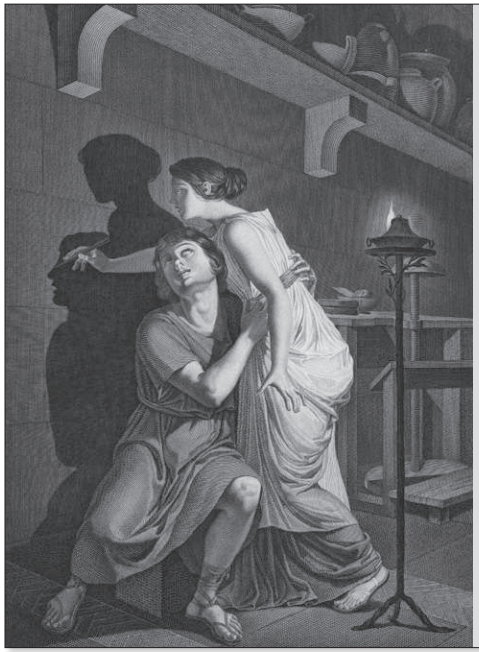
Storage has brokered a merger between geometry and data. Today, a building model is essentially a telematic database, a 3D container in which building form and information commingle in order to produce almost any genre of visualization, whether construction plans, photorealistic renderings, or a sheet of specifications. Over the course of CAD and BIM software history, architecture's image (what a building looks like) had been so actively engineered into a computable data structure that it could take on typically onerous roles of calculation (what a building is composed of, how much it would cost) and simulation (how a building would perform) with greater speed and exactitude. According to Daniel Cardoso Llach, early CAD engineers "saw in the 'structured' character of the computational image an opportunity to reimagine design and construction practices as the manipulation of interconnected bundles of information," giving rise to "a new epistemology of design representation construing images as *engineered artifacts*."[23] Ivan Sutherland himself had plainly redefined the drawing as a machine-readable description in 1975:

> As soon as the process of computer-aided design is considered as building a *computerized description* of the object being designed rather than as the *process of drawing* the object being designed, horizons become tremendously expanded. In the architectural

21 Soenke Zehle and Ned Rossiter, "Mediations of Labor: Algorithmic Architectures, Logistical Media, and the Rise of Black Box Politics," *Organized Networks: Invent New Institutional Forms* (blog), accessed November 28, 2022, https://web.radzer.org/?p=453.

22 See Shannon Mattern, *A City Is Not a Computer: Other Urban Intelligences* (Princeton, NJ: Princeton University Press, 2021), Shoshanna Zuboff, *The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power* (London: Profile Books, 2019), and Orit Halpern, Robert Mitchell, and Bernard Dionysius Geoghegan, "The Smartness Mandate: Notes toward a Critique," *Grey Room* 68 (Summer 2017): 106–29.

23 Daniel Cardoso Llach, "Architecture and the Structured Image: Software Simulations as Infrastructures for Building Production," in *The Active Image: Architecture and Engineering in the Age of Modeling*, ed. Sabine Ammon and Reinat Capdevila-Werning (Cham, Switzerland: Springer Verlag, 2017), 21–36; emphasis added.



Ends of Drawing

John McMorrough

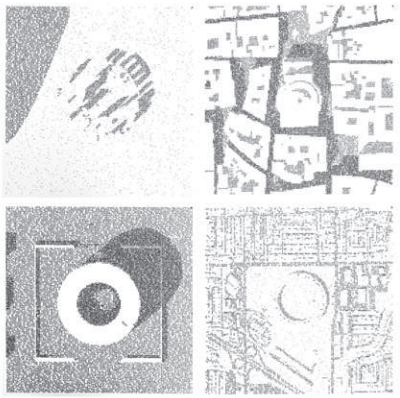
Drawings are representational and projective, generated from material conditions, recording intention, entailing purpose, confronting resistance. The associations of drawing with the interaction of matter and embodied (human) effort are rendered in its etymology. In Old English, dragan, *following the German* tragen, *is to pull or drag, as in pulling a plow, analogous to pulling a stylus across a surface to make a mark. To convey information, drawings are arrangements of technique, enacting conventions in anticipation of desired meanings. In addition to being an action, a drawing is also a product of its circumstances, emerging in relation to both the material conditions of its realization and the historical possibilities afforded at the moment of its creation. As it acts (represents and creates) and as it enacts (conventions old and new), each drawing is a record of two worlds: the world made within the drawing and the world in which it is made. The usefulness of drawing is not only in accomplishing its purpose, whether utilitarian or artistic, but also in indexing the conditions, forces, and circumstances of its creation.*

SHADOW

A primary, perhaps even originary use of drawing is to record, liberating appearance from the circumstances of its occurrence, preserving it for a duration (the drawing lasts for as long as the integrity of its materialization), and encapsulating it for transmission beyond the subject of its description. The origin of this capacity of drawing to capture a likeness is imagined in the myth of the Corinthian maid, who, to preserve the countenance of her lover, soon to depart for war, traces the outline of his shadow on a wall. The outlining of the silhouette stages the drawing as a copy, as partial satisfaction of the desire for that which exists but is inaccessible. The recording of silhouette drawing requires the interaction of illumination (the light source to create the shadow), surface (the shadow as it falls on the wall), tool (the inscribing stylus), and manipulation (the hand holding the stylus). The story reflects conditions out of which subsequent drawings are considered: how the mediation of technique (the

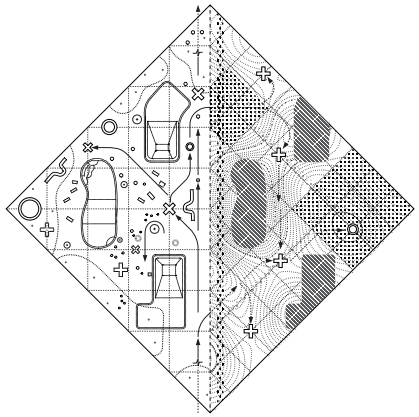
Fig. 1
Pieter Jan de Vlamynck (Belgian, 1795–1850), after Joseph-Benoît Suvée (Belgian, 1743–1807), *The Invention of Drawing*, after 1791.

Selected essay spreads from the book.



Theory of Forms, Nos. 1, 3, 4, and 7
modem / Kathryn Moll and Nicholas de Monchaux

Text—codes, standards, and specifications—shape the form of contemporary buildings in a measure greater than lines. We depict the public realm of several historical examples—Stonehenge, the Pantheon, the Hirshhorn Museum, and *Apple Park*—using the text of the written regulations governing their construction and use. In the buildings' shadows, we describe the structures' circular affinity outside of time and circumstance, using *pi*, the mathematical constant. Produced using a typewriter, the drawings are precise, but at a coarse resolution; they question our increasing assumptions about the detail and precision that we use to describe our environment, and the veracity and quality of the depictions that result.



Half-Hearted Diamonds
Jimenez Lai

When Theo van Doesburg rotated the square, an important disagreement occurred with Piet Mondrian: Should the grid travel with the frame, or should the power of the grid be resistant to rotation? More importantly, should the frame be rotated at all?

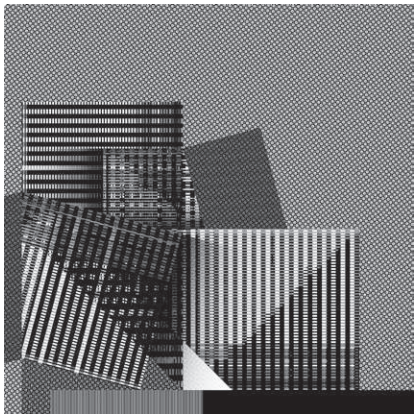
Using this frame of reference, we are using this drawing to re-examine the Diamond House by John Hejduk. By describing a circulatory choreography between two halves of the same square, two rules are established and violated at the same time, like halves of the same evil twin. One that rotates, and one that does not.

Hideout, East Elevation
Catie Newell / Alibi Studio

The code is in the signals between our eyes and our brains. We each see a different darkness. The contrasts that our eyes distinguish, the extent of our peripheral vision, our sensitivities to light, and our blind spots—all make the work different for each one of us.

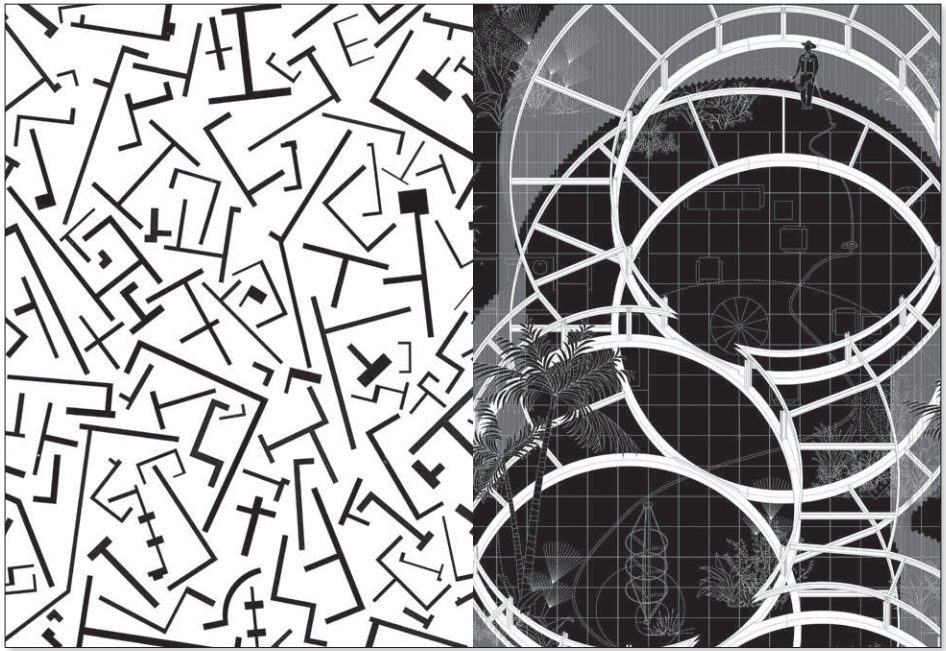
Black ink is absorbed across the entire field of the paper, requiring its contrast, white, to come from removal alone. Light, in the form of a laser, is used to subtract the darkness, burning it quickly and crisply, defining a sharp edge. Layered together, the razed darkness slips and overlaps, extending vertically and mingling the attenuations. Light and dark tumble over each other, with processes of addition and subtraction existing to different degrees of clarity. The overlay and patterning cause visual interferences that create additional black lines, even patches that are not in fact there.

The drawing is an elevational study for a hidden studio space, the Hideout. The facade allows light to penetrate to the interior, while darkness hovers on the exterior. Approach, time of day, and the code specific to the onlooker's eyes will all determine what is actually seen. Its appearance is based on optical addition by physical subtraction.



Building Portrait
Elena Manferdini

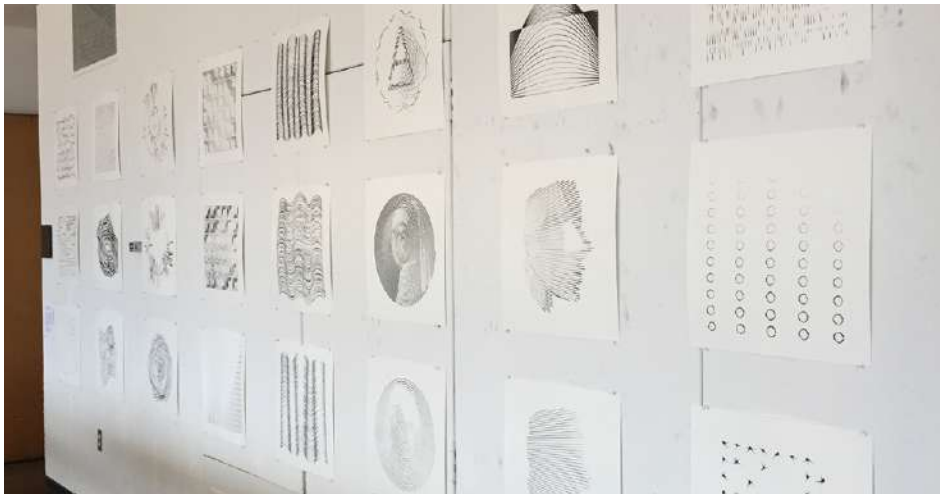
This drawing is part of a suite of elevation studies called *Building Portraits* developed by Atelier Manferdini. These drawings explore the potential of intricate scripted linework depicting building facades. The collection exists simultaneously as architectural research and as autonomous artwork. These drawings can be understood as scaled-down reproductions of imaginary buildings, and at the same time as full-scale printed artifacts. The collection plays with the graphic potentials of woven grids and scripted vector lines, while exploring the canonical relationships of shape versus form, ground versus figure, pattern versus coloration, orientation versus posture. The title of the suite, *Building Portraits*, alludes to two distinct disciplines: the field of architectural drawings—building—and the field of fine art pictures—portraits. This body of work tries to claim a territory where these two attitudes find a common ground, where pixels and vectors get closer in scale of perception. This research updates the project of the grid in the age of computation and globalization. The belief behind this work is that when the grid is applied to city facades with a revised contemporary materiality and computational geometry, it is able—once again—to estrange the buildings from the ordinary and render them as unique architectural experiences.

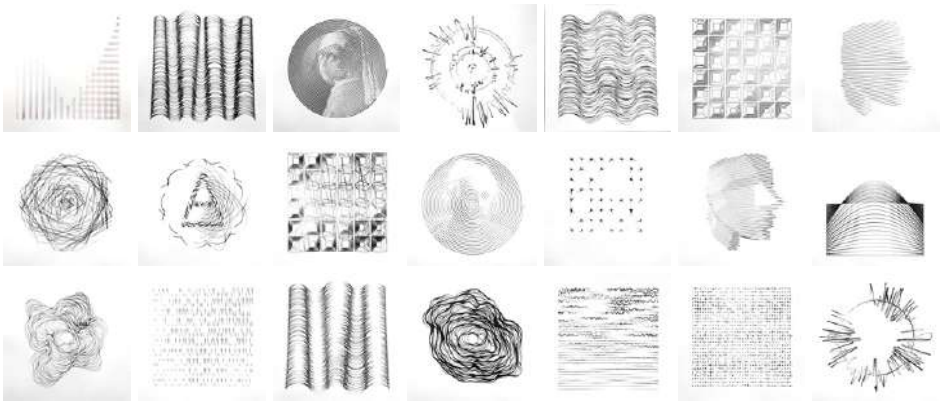


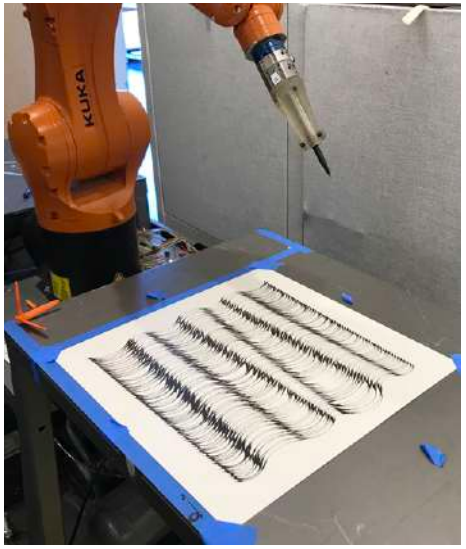
As a way to further promote a dialogue between and among individual contributions, each drawing is shown twice in the book. Each instance—one sized to 7" to show the drawing in its entirety, and one cropped at "full scale" to convey the detail of the original artifact from the exhibition—is paired with a different drawing from the collection. The spreads alternate between 7" pairings and detail pairings, creating a rhythm and flow between the works.

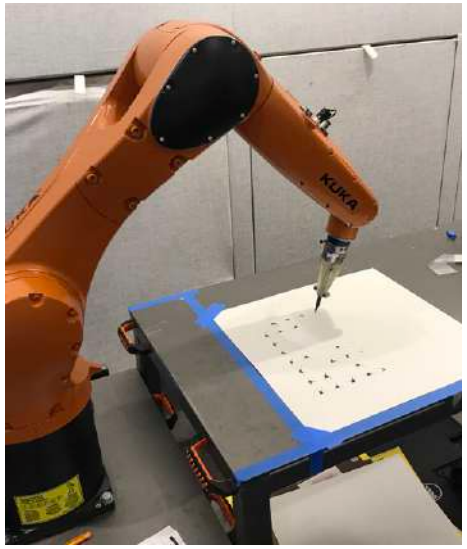
5. WORKSHOPS

As the *Drawing Codes* exhibition traveled to schools throughout the country, we had the opportunity to lead several workshops exploring procedural and computational approaches to architectural representation. These workshops explored a range of techniques, from robotic drawing to procedural urban designs to collaborative rule-based drawing. The workshops have provided space for technical experimentation but also for collaboration, critical dialog, and conversation among students and faculty about the changing role of technology in architectural representation.





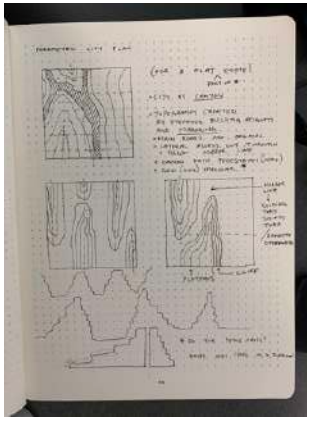


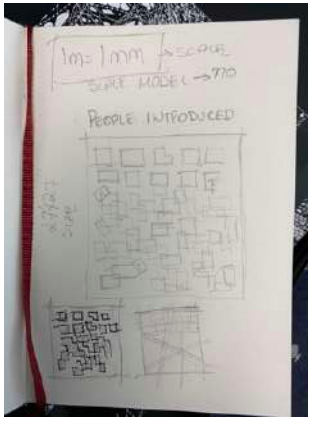


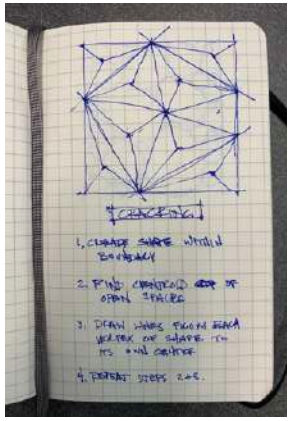
ROBOTIC DRAWING CODES WORKSHOP / UNIVERSITY OF VIRGINIA
Adam Marcus, Andrew Kudless, and Melissa Goldman, March 2019

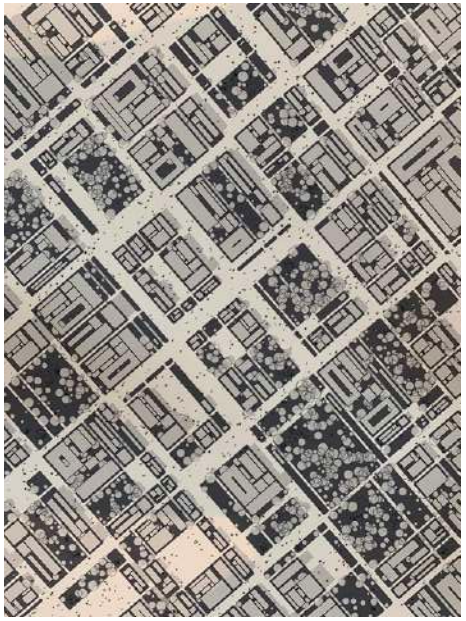
On occasion of the opening of Volume II of the exhibition at the University of Virginia School of Architecture, Marcus and Kudless led a two-day robotic drawing workshop in collaboration with UVA Fablab director Melissa Goldman. The intent was to build upon the themes of the exhibition by investigating procedural logics of computational and robotic drawing using the School's 6-axis Kuka robot arm.

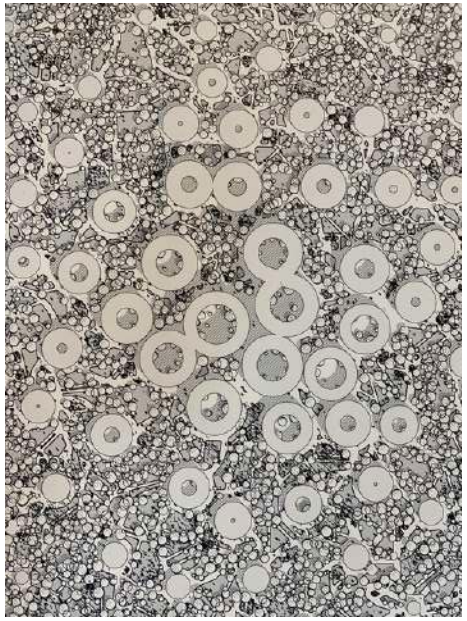
The two-day workshop explored parametric approaches to constructing two dimensional drawings, and how these drawings can be translated to three-dimensional instructions for a 6-axis robotic arm. Specific emphasis was placed on developing workflows that are unique to the robot arm's 6-axis capabilities: techniques of twisting, turning, varying the "wrist" angle, and modulating line weight in ways that would otherwise not be possible with a standard 3-axis machine or 2-dimensional plotter. Students produced a number of iterative robotically produced drawings, which were exhibited and discussed in a public roundtable marking the opening of the Drawing Codes show.

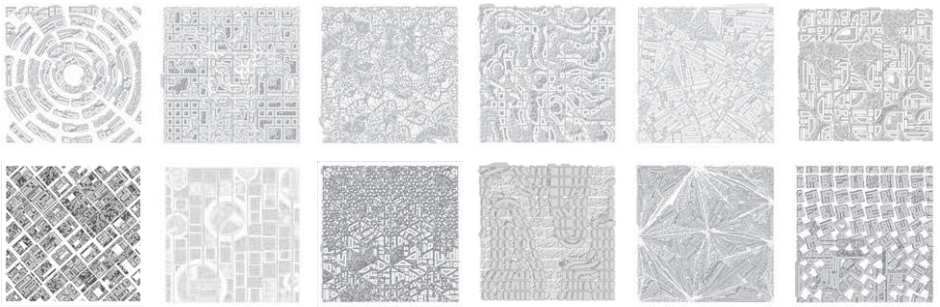


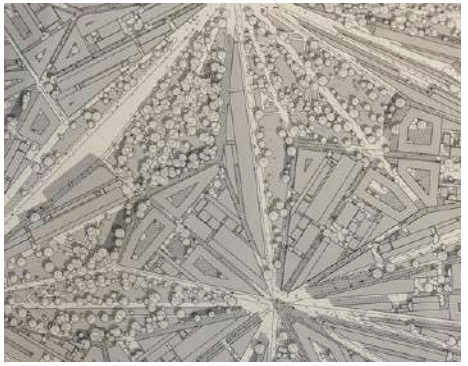


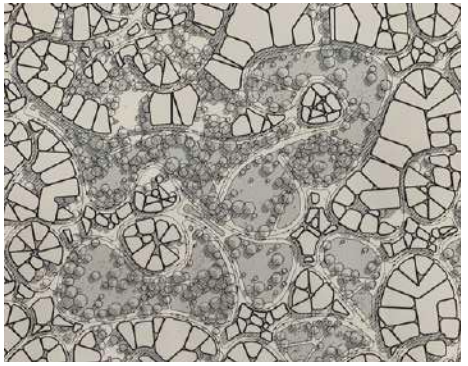






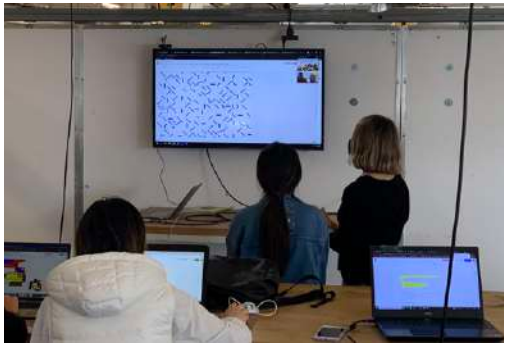






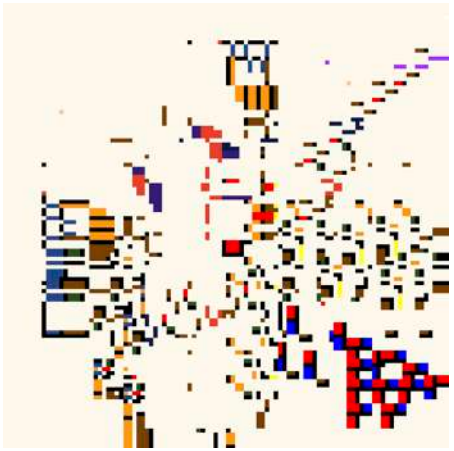
SCRIPTED URBANISM WORKSHOP / UNIVERSITY OF MIAMI
Adam Marcus and Andrew Kudless, September 2019

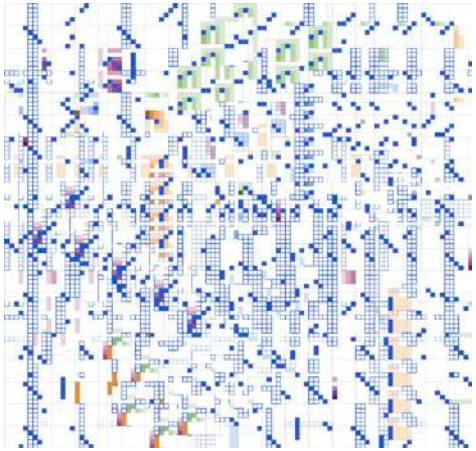
In conjunction with the opening of Volume II of the exhibition at the University of Miami School of Architecture, Marcus and Kudless led a one-day workshop for architecture students at the school on procedural logics of computational drawing. Building upon the themes of the exhibition, the workshop explored parametric and algorithmic approaches to constructing two-dimensional urban plans. Each workshop attendee explored a set of rules that parametrically produced a plan drawing of a city. At the end of the workshop these plans were tiled together to produce a larger city plan composed of the diverse rule sets of the attendees.

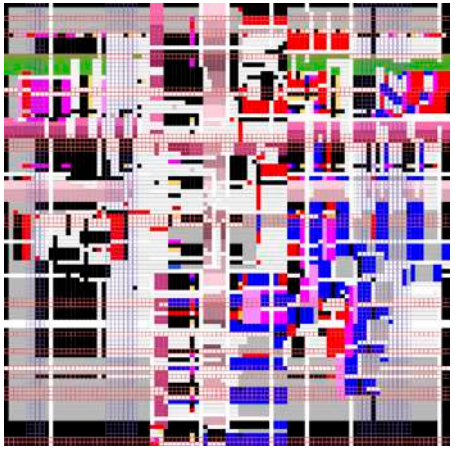


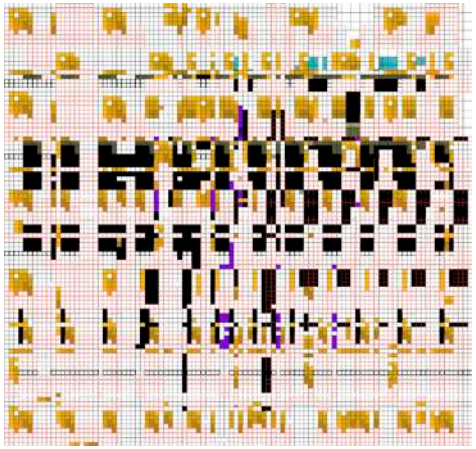
DRAWING AFIELD WORKSHOP / CALIFORNIA COLLEGE OF THE ARTS
Ashley Bigham and Erik Herrmann, September 2021

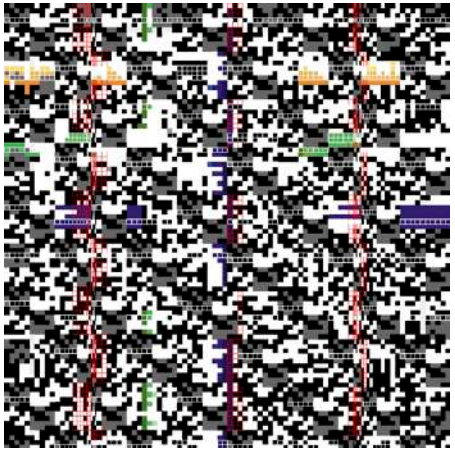
In parallel with the opening of Volume II of the exhibition at California College of the Arts in fall 2021, Ashley Bigham and Erik Herrmann of Outpost Office were invited to lead a one-day workshop exploring real-time networked creativity. Given that the campus had just recently reopened and was still operating under pandemic protocols, Bigham and Herrmann led the workshop remotely via Zoom rather than traveling to San Francisco to be in-person. In the workshop, students worked collaboratively via Google Sheets to produce rich and complex digital drawings through generative, procedural, and deductive processes. By developing techniques of image manipulation that are unique to the collaborative graphic interface of Google Sheets, students transformed precedent patterns into highly dynamic visual compositions. The "history" of the evolution of the drawing within Google Sheets was animated and projected at large scale in the school's main space, marking the first collective event held at CCA since the start of the pandemic.











6. DISSEMINATION, IMPACT, AND INSTITUTIONAL SUPPORT

The *Drawing Codes* project has been published widely, both in scholarly publications with papers written by the curators and in the architectural press with reviews of the traveling exhibition. The project has also received over $60,000 of support from a wide array of institutional and industry sponsors.

Peer Reviewed Publications by Curators

- Adam Marcus and Andrew Kudless. "Drawn Together: Coding and Curating Architectural Drawing After Computation." *Technology: Architecture/Design* (TAD), v. 8, no.2: Coding, 2024.
- Adam Marcus and Andrew Kudless. "Drawing Codes: Experimental Protocols of Architectural Representation." Recalibration: On Imprecision and Infidelity. *Proceedings of the 38th Annual Conference of the Association for Computer Aided Design in Architecture*. Phillip Anzalone, Marcella del Signore, and Andrew John Wit, eds., 2018.

Selected Press for *Drawing Codes* Exhibition

- Davis Richardson, "Drawing Codes compiles 96 works to explore computation's agency to generate drawings without models" *Architect's Newspaper*. October 30, 2024.
- Duncan Allen, "Cooper Union exhibition rethinks the age-old act of drawing," *Architect's Newspaper*. January 9, 2019.
- Michael Jefferson, "In a Room Together." *Interiors: Design/Architecture/Culture* 9:3, June 2019.
- Niall Patrick Walsh, "Exhibition Images explore how Coding can Impact Architectural Representation," *Arch Daily*. January 3, 2019.
- Matthew Marani, "Ten Architecture Shows to See in 2018," *Architect's Newspaper*. January 29, 2018.
- Blaine Brownell, "The Intersection of Code and Drawing." *Architect*. January 27, 2017.

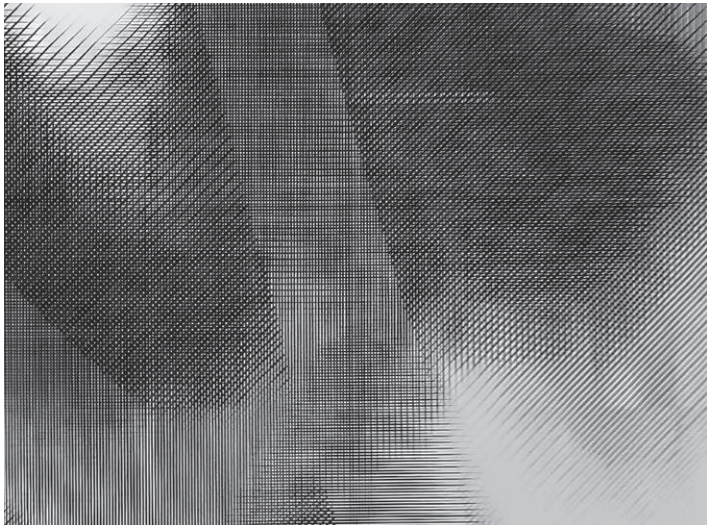
Sponsorship and Support for *Drawing Codes* Project

Exhibition Grants:

- California College of the Arts
- Woodbury University School of Architecture
- Taubman College of Architecture and Urban Planning, University of Michigan
- Knowlton School of Architecture, The Ohio State University
- The Cooper Union
- University of Virginia School of Architecture
- University of Miami School of Architecture
- University of Washington College of Built Environments
- The Miller Hull Partnership
- University of Houston
- Tulane University

Publication Grants:

- CCA Architecture Books
- University of Houston
- Favrot Research Center Fund, Tulane University School of Architecture



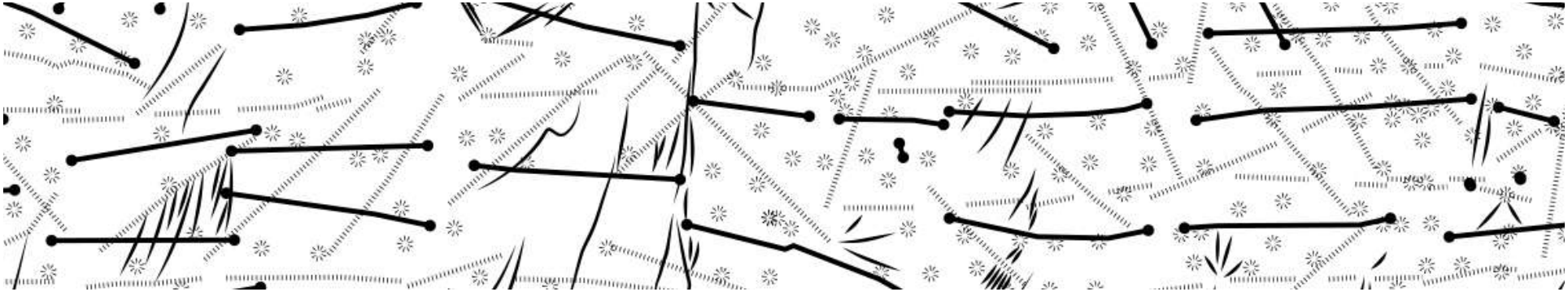
Detail, *Folds* by Curime Batliner

"Despite the uniformity of these works' black-and-white, 2D format—or perhaps because of it—*Drawing Codes* presents a surprisingly varied spectrum of ideas, questions, and explorations concerning the role of architectural representation today."
— Blaine Brownell, *Architect*

"The exhibition challenges the notion of a unifying stylistic ambition, instead emphasizing computation as a lens through which to register the plurality of voices present in the design field today... Ultimately, *Drawing Codes* is less interested in curating a singular notion of computation in design today than it is in curating a conversation between a diverse set of designers that harbor their own takes on the topic."
— Michael Jefferson, review in *Interiors: Design/Architecture/Culture*

"And yet, even with such strong guidelines, the differences and creativity in each piece are astonishing."
— Duncan Allen, *Architect's Newspaper*

"If everyone's doing the same thing, then how each person does it becomes more revealing."
— Geoff Manaugh, *BLDGBLOG*



Detail, *Blue Tarp* by AD—WO

PROJECT CREDITS

Curators & Project Leads:
Adam Marcus & Andrew Kudless

Exhibition Assistants:
Gina Bugiada, Lina Kudinar, Marc Northstar

Exhibition / Gallery Staff:
Jaime Austin, Sandhya Kochar, Mary-Ann Wilkinson, Steven Hillyer, Sneha Patel, Shawna Meyer, Joshua Polansky, Bryndis Hafthorsdottir, Manuel Angeja

Book Template Graphic Design:
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Book Copy Editor:
Paula Woolley

UVA Robotic Drawing Workshop, March 2019:
Instructors: Adam Marcus, Andrew Kudless, Melissa Goldman
Students: Michael Beaman, Matt Gordon, Nicholas Grimes, Jack Hatcher, Matt Johnson, Sam Johnson, Katie LaRose, Evan Sparkman, Michael Tucker

University of Miami Scripted Urbanism Workshop, September 2019:
Instructors: Adam Marcus and Andrew Kudless
Students: Sofia Contreras Ojeda, Maxwell Jarosz, Shane Jezowski, Michael Kundin, Johnny Laderer, Jennifer Lamy, Teagan Polizzi, Alexandra Remos, Madison Seip, Gabriel Soomar, Reid Yenor

CCA Drawing Afield Workshop, September 2021:
Instructors: Ashley Bigham and Erik Herrmann
Students: Yitian Ma, Amalia Pulgar, Hsiao Chun Hou, Wing Kiu Ho, Saina Gorgani, Vishakh Hiren Surti, Maryam Liaghatjoo, Ahmad Alajmi, Abraham Castro, Chizumi Kano, David Rico-Gomez, Ki Schmidt, Mengjie Shen, Alana Abuchaibe, Conrad Scheepers, Anbin Liu, Colin Murdock

PROJECT METRICS

Project Title:
Drawing Codes: Experimental Protocols of Architectural Representation

Month/Year Completed:
October 2024 (publication of book)

Role of Nominees:
Adam Marcus and Andrew Kudless are collaborating curators and directors of the *Drawing Codes* project, and co-authors of the *Drawing Codes* book.

Collaborators & Funding Sources Expenses:
- Please see previous page 19 for list of funding sources.
- Each of the nine iterations of the traveling exhibition included several hours of staff and student labor for installation and de-installation. All labor was compensated via staff salaries and student work-study positions.
- The book production included hiring a graphic designer to develop a template design, and a copy editor who was paid hourly to review the book text.

Student Compensation:
- All student exhibition assistants were paid hourly via work-study positions.
- All workshops were structured as extracurricular optional workshops, offered at no cost and with no credits awarded.