Massachusetts
Institute of
Technology

**MIT Center for Art,
Science & Technology**

2020–21 Programs

The
**/ARTS
/AT MIT**
**are rooted in
experimentation, risk-
taking, and imaginative
problem-solving.**

Cover image: Exhibited at the 2021 Venice Architecture Biennale, *Open Collectives* is an immersive
installation featuring digital platforms and architectural projects that seek to leverage the power of
solidarity in order to strengthen economic sovereignty, housing affordability, communal self-determination,
and mutual aid. Designed by Associate Professor of Architecture and Urbanism Rafi Segal, the station's
suspended single surface creates an open, yet semi-enclosed, space for learning about an emerging
architecture for collectives around the world. Credit: Marisa Morán Jahn.

In This Issue

From the Directors

In an academic year unlike any other, it would have been entirely justified—perhaps even prudent—for a Center devoted to art and its intersection with community to suspend or severely pull back operations, hunker down, and wait for better times. But the very forces that might have argued for this expediency were in fact what compelled forward motion, adaptation, and reinvention. The challenges we faced, whether social or logistical, required an inherent awareness and commitment—from how we interacted with and treated one another to how we walked the line between safety and danger. These concerns were not sidelined by social distancing and societal upheaval, but rather were heightened by them. They could not be evaded, and they were more pressing than ever to artists, researchers, and members of the body politic. CAST's small role was thus to facilitate response and engagement.

During academic year 2020–21, we at CAST did our best to adapt our core mission—to foster connections among art, science, and technology, or, to put it in more humanistic terms, among artists, scholars, scientists, and technologists—and to deploy our resources and infrastructure accordingly. To do this, we looked to the community itself, not only to artists and researchers at MIT, but also to our intrepid and engaged staff, who felt—and expressed—the same urgent need to address these issues, in real time, with the ground shifting under everyone's feet.

Looking back over the entire year, we see just how much new territory was covered, and how much of it has a permanence, or at least an ongoing effect. Some programs conceived ad hoc, frankly as humble placeholders, turned out to have a large impact. When the entire campus shifted to remote learning in March 2020, CAST initiated a lightning round of grants, "Visiting Artists into the Virtual Classroom." This succeeded beyond our expectations and was continued throughout the following academic year, bringing more than 85 artists into substantive contact with students. These encounters enlivened the "classroom" at a time when faculty and students confronted a stressful and diminished learning experience, and also revealed some of the benefits of virtual visits. By lowering costs and widening availability, CAST was able to reach beyond the arts curriculum and introduce artists into a wide array of classes—including, for example, data visualization, foreign languages, health sciences, psychology, science writing, and science, technology, and society. These "short burst" interventions were complemented by the appointment of three Virtual Visiting Artists in music for the entire academic year. Distinguished musicians Don Byron, Anat Cohen, and Luciana Souza gave master classes, private lessons, lectures, and performances to an array of ensembles, studios, and academic classes, bringing to the curriculum knowledge of specific, underrepresented musical cultures. The residencies also provided material and personnel resources to each of the artists to advance their own work, at a time when their livelihoods and touring schedules were curtailed by the pandemic.
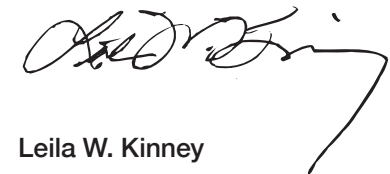
In another initiative, CAST partnered with MIT's Open Documentary Lab (OpenDocLab) and Black Public Media to inaugurate a new fellowship. The MIT & Black Public Media Fellowship connects Black creatives to the OpenDocLab's network of scholars and technologists to develop emerging-tech storytelling skills. Inaugural fellows were Carla LynDale Bishop and Fabiano Mixo. Bishop's project, *Mapping Blackness*, uses traditional film, augmented reality (AR), and geo-tagged media assets to co-create profiles of historically Black communities in the United States with members of each community. Mixo's *Meshmemories* is an AR sculpture of Mãe Beata de Iemanjá, a Brazilian writer, activist, and religious leader.

With the impossibility of long-distance travel and large convenings, CAST's third symposium, "Unfolding Intelligence: The Art and Science of Contemporary Computation," also had to be reconceived virtually. CAST postdoctoral fellow William Lockett spearheaded its transformation into a substantive 10-day series of events. Keeping art itself as the epicenter, this included an exhibition of more than a dozen original generative artworks, curated by Professor of Digital Media Nick Montfort. The symposium was originally to have included the world premiere of Distinguished Visiting Artist Matthew Ritchie's *The Invisible College*, a site-specific, immersive work involving augmented reality, virtual reality, and live performance, exploring in situ the information and physical spaces that constitute the Institute's creation of scientific knowledge. Ritchie adeptly pivoted and used his material to create *Color Confinement*, an AR enhanced 360-degree video of the abandoned campus, a version of which premiered during the symposium.

Work on more ambitious CAST-sponsored projects also continued, and by the end of the academic year began to be realized. We are particularly proud to have funded multiple installations at the 2021 Venice Architecture Biennale, curated by MIT Dean of Architecture Hashim Sarkis. The remarkably prescient theme of the biennale—"How Will We Live Together?"—sums up the experience of the entire year, and the responses—by MIT architects, designers, and artists represented at the biennale and by the CAST community over the course of this past academic year—give us hope that ways forward will continue to be found.

Evan Ziporyn
Kenan Sahin (1963) Distinguished
    Professor, Music and Theater Arts
Faculty Director, CAST
Artistic Director, *MIT Sounding*

Leila W. Kinney
Executive Director of Arts Initiatives
Executive Director, CAST

CAST Mission Statement

The MIT Center for Art, Science & Technology (CAST) creates new opportunities for art, science, and technology to thrive as interrelated, mutually informing modes of exploration, knowledge, and discovery. CAST's multidisciplinary platform presents performing and visual arts programs, supports research projects for artists working with science and engineering labs, and sponsors symposia, classes, workshops, design studios, lectures, and publications.

CAST Activities

Cross-Disciplinary Classes

Soliciting and supporting cross-disciplinary curricular initiatives that integrate the arts into the core curriculum and create new artistic work, materials, media, and technologies for artistic expression.

Public Outreach

Disseminating to the public the creative and intellectual production supported by the Center through performances, exhibitions, installations, videos, publications, and a biennial symposium.

Residencies

Producing a Visiting Artists program that emphasizes research and development of creative work, cross-fertilization among disciplines, and extensive interaction with MIT faculty, students, and researchers.

Support

Assisting in the presentation and curation of art relevant to the research of engineers, scientists, and the MIT community as a whole; supporting faculty, students, and postdoctoral researchers whose work advances the mission of the Center.

2012–21 Program Statistics

5,800+ students participated in classes.

150+ MIT faculty and staff representing all five schools collaborated with CAST.

280+ Visiting Artists engaged with students during **200+** class visits.

32,600+ people attended **230+** public programs in person, and another **8,200+** joined via live web streams.

70+ collaborative projects appeared in significant festivals or exhibitions in Amsterdam, Basel, Berlin, Cairo, New York, Paris, São Paulo, Tel Aviv, Tokyo, Toronto, and Venice.

Funders

The Center for Art, Science & Technology is funded, in part, through 2024 by a grant from the Andrew W. Mellon Foundation. Additional support comes from Dasha Zhukova; Michael and Sonja Koerner; the late Fay Chandler; Ron and Carol Kurtz; Joan and Paul Gluck; Terry and Rick Stone; Eugene Stark; Peter Athens; and other individual benefactors. MIT support comes from Philip S. Khoury, Associate Provost with responsibility for the arts; Melissa Nobles, Kenan Sahin Dean, School of Humanities, Arts, and Social Sciences; Hashim Sarkis, Dean of the School of Architecture + Planning; and the Council for the Arts at MIT.

Partners at MIT

Office of the Provost
List Visual Arts Center
MIT Museum

Office of the Vice President for Research
MIT.nano

School of Architecture + Planning (SA+P)
Architecture
Art, Culture, and Technology
Community Innovators Lab
History, Theory, and Criticism of Architecture and Art
Media Lab
Urban Studies and Planning

School of Engineering
Aeronautics and Astronautics
Civil and Environmental Engineering
Computer Science and Artificial Intelligence Laboratory
Electrical Engineering and Computer Science
Glass Lab
Materials Science and Engineering
Mechanical Engineering

School of Humanities, Arts, and Social Sciences (SHASS)
Anthropology
Comparative Media Studies/Writing
Global Studies and Languages
History
Linguistics
Literature
Music and Theater Arts
Science, Technology, and Society

School of Science
Biology
Brain and Cognitive Science
Earth, Atmospheric, and Planetary Sciences
Edgerton Center
Laboratory for Multiscale Regenerative Technologies
McGovern Institute
Physics

Sloan School of Management
Martin Trust Center for MIT Entrepreneurship
MIT Leadership Center

Student Life
Concourse Program
Hillel Program
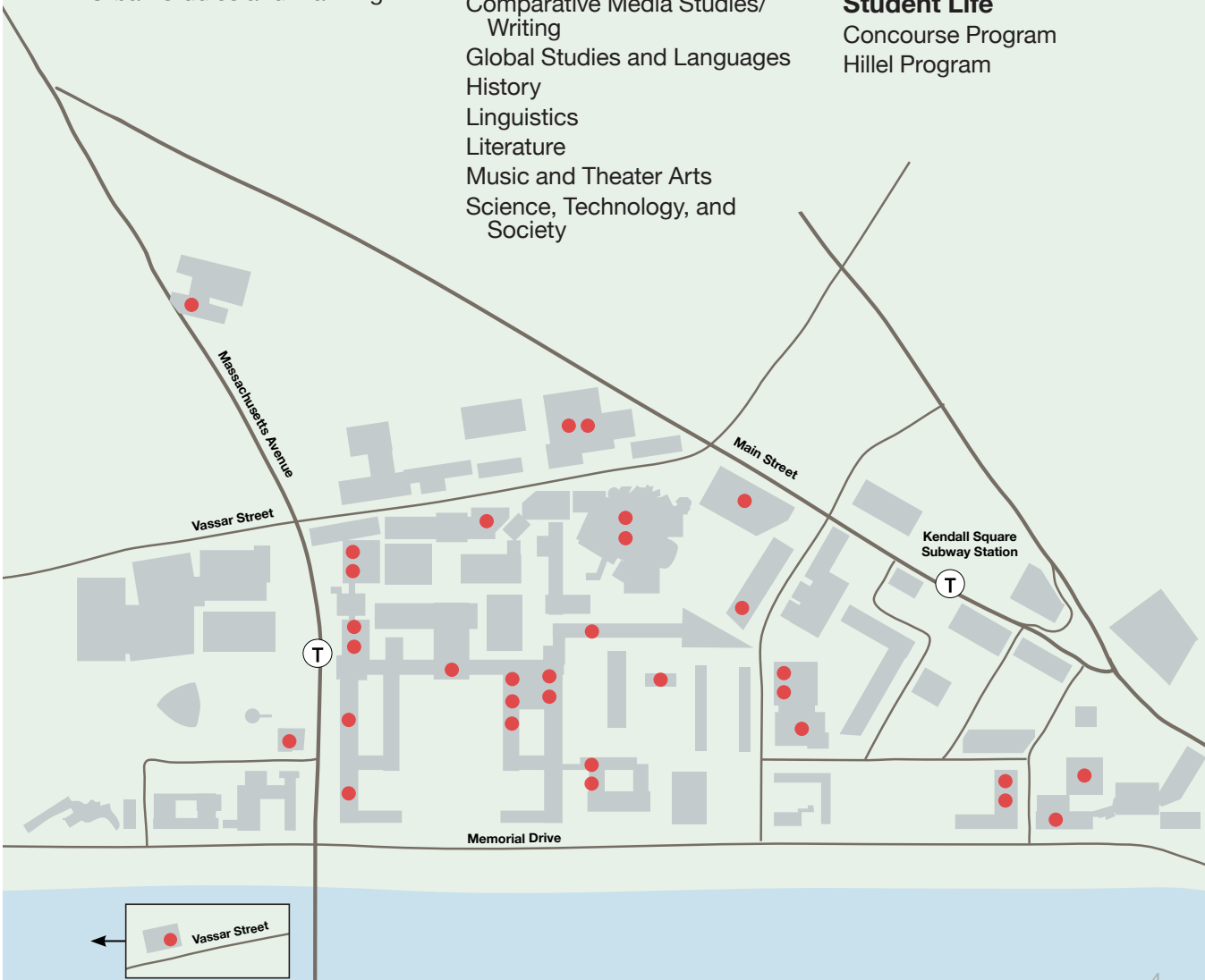
Black Media Futures

Against a backdrop of renewed calls for racial justice accompanying the historic global mass protests of 2020, these artists and storytellers developed new work to illuminate and celebrate Black stories.

This year, MIT's Open Documentary Lab partnered with the long-standing nonprofit Black Public Media and CAST to fund a new fellowship for a Black documentarian, artist, journalist, or creative technologist who is using emerging technologies or old technologies in new contexts. Fellow Carla LynDale Bishop, in her project *Mapping Blackness*, shines a light on small-town Black America, the people and places so often overlooked by mainstream media, while Fabiano Mixo extends his boundary-pushing work in cinematic portraiture to create an augmented reality (AR) documentary about Beatriz Moreira Costa, the celebrated activist of Brazil's social justice movements. In honor of Black History Month, MIT alum Dr. Daniel Chonde SB '07, PhD '15, a radiology resident at Massachusetts General Hospital, orchestrated a series of digital concerts and performances by local theater groups as part of the 2020–21 *MIT Performing* Series. Through theater, dance, and film, the varied works explored themes of wellness, healing, and care.

Using augmented reality, data visualization, 360-degree video, and geo-tagging, alongside traditional documentary and performance, these works find innovative new ways to convey the vibrancy and complexities of Black experiences.

Image: Film still from "Woman Without Mandolin," 2015. Courtesy of Fabiano Mixo.

Mapping Blackness: A Digital Archive of Black Communities

A cartographic exploration of place and identity

Research Project: *Mapping Blackness,* an Immersive Geo-Locative Media Platform

The work of filmmaker and educator Carla LynDale Bishop blends traditional documentary with new technologies to tell place-based counter-narratives, leveraging new media to promote social change. In 2013, Bishop founded Focused.Arts.Media.education (FAMe), an organization that trains young people to tell the stories of their communities. *Mapping Blackness* is a geo-locative digital mapping platform that she created, which documents the presence of historically Black communities unidentified by standard geo-tagging practices.

As the inaugural MIT & Black Public Media Visiting Artist, Bishop has been able to further develop her work on two augmented reality documentaries: *Voices on the Hill*, which chronicles the community of Twinsburg Heights in Ohio, and *Freedman Town 2.0*, which focuses on Southeast Denton in Texas (formerly known as Freedman Township). These are towns that few would pause to notice while driving through, and they are not always included on standard maps. Nonetheless, each community maintains a thriving culture and a pride in local history, and Bishop is determined to preserve their civic legacies. After producing the two documentaries, she realized that a platform was needed to archive and share the work with a wider audience. *Mapping Blackness* makes these stories accessible and interactive, applying mapping and analytic technologies and working collaboratively with community members, technologists, students, and filmmakers.

Images: (left) Carla LynDale Bishop gives input on documentation. Credit: L.A. Bishop. (above) *Mapping Blackness.* Courtesy of Carla LynDale Bishop.
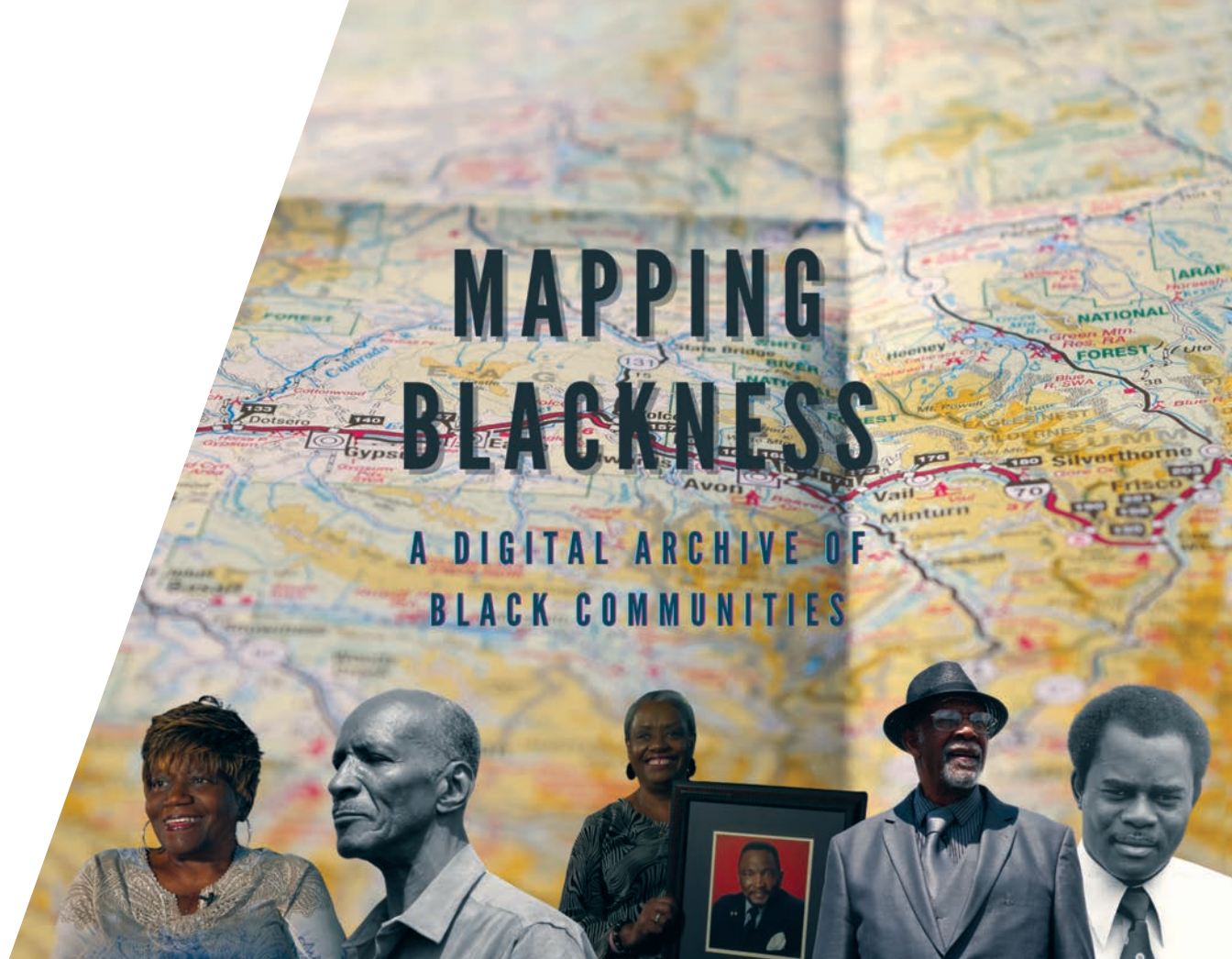
"With *Mapping Blackness*, my goal is to really honor Black communities and shine a spotlight on the everyday people who helped build them. I want to celebrate them, highlight their impact, and make it possible for their relatives and people around the world to share in their stories and experience these neighborhoods."

– Carla LynDale Bishop

As a way of honoring the place of historically Black communities both spatially and culturally, *Mapping Blackness* introduces a new progressivism to the ideal of inclusivity. The practice of recording and visualizing becomes a collective act, fostering a greater understanding of the relationship between place and identity.

MIT & Black Public Media Visiting Artist

Carla LynDale Bishop, Assistant Professor in Digital Storytelling, University of Oklahoma–Norman

Black Public Media

MIT Open Documentary Lab

Meshmemories
An experiment in augmented reality portraiture

Research Project: *Meshmemories*, An Augmented Reality
Portrait of Mãe Beata de Iemanjá

MESHMEMORIES
By Fabiano Mixo

Meshmemories is an augmented reality (AR) portrait of Beatriz Moreira Costa, known as Mãe Beata de Iemanjá, a prominent Candomblé high priestess and activist who dedicated her life to the preservation of traditional African religions, culture, and education in Brazil. Created by the Brazilian artist and filmmaker Fabiano Mixo, MIT & Black Public Media Visiting Artist, the project applies 3D compositing, animation, and sound design to create an AR documentary synthesizing images from Mãe Beata's photo archive.

"It's been amazing and inspiring to be a part of a community of people seeking knowledge, looking for different ways of doing things, and creating new forms, and new narratives, and new technologies."

– Fabiano Mixo

Mixo grew up in the city where Mãe Beata lived and worked, and has firsthand experience of her enduring social justice legacy. As a champion of anti-racism, religious tolerance, women's rights, and HIV/AIDS education, Mãe Beata's spirit is sustained by contemporary activist movements. *Meshmemories* traces and illuminates this continuum between past and present. In the context of Afrofuturist histories, time itself becomes hybrid and defiant; by combining intersecting chronologies and multiple perspectives, Mixo questions linear narratives and proposes new and networked ways of knowing.

Mixo first developed a language of cubist documentary in his film, *Woman Without Mandolin*, which critiques the presence of African iconography within Picasso's painting *Girl with a Mandolin* and forms a fluctuating portrait of the singer and actress Miriam Goldschmidt. *Meshmemories* takes those early experiments in new directions, splitting the singular lens of traditional documentary and expanding the possibilities of new media portraiture. As the study of a life that touched many others, *Meshmemories* envisages a new relational aesthetics, reconstructing the image of a figure who continues to inspire solidarity within the African diaspora.

Images: (left) Fabiano Mixo directs "Children Do Not Play War," which was released in 2019 in stereoscopic virtual reality film format. (right) Portrait of Mãe Beata de Iemanjá. Courtesy of Fabiano Mixo.

MIT & Black Public Media Visiting Artist

Black Public Media

MIT Open Documentary Lab

Fabiano Mixo, Artist, Filmmaker, Founder, and Creative Director, VILD Studio

A Black History Month Celebration

Performance and the practice of care

Virtual Event: *Soul Break with Front Porch and Fam*, February 22, 2021

Virtual Event: *Young Nerds of Color*, February 23, 2021

Virtual Event: *Fabulation, or The Re-Education of Undine*, February 25, 2021

In honor of Black History Month, Massachusetts General Hospital presented a three-day program of performances in collaboration with local theaters in the Greater Boston area. The event was organized by MGH radiology resident and MIT alum Dr. Daniel Chonde (SB '07, PhD '15), and was supported by the *MIT Performing* Series, the research-based prototyping and performance platform led by Professor Jay Scheib.

Chonde initially studied with Scheib during his time as an undergraduate at MIT. Together, they developed a digital lineup that included music-driven projects from Castle of our Skin, HipStory, and BAMS Fest, and theatrical presentations such as Melinda Lopez's work-in-progress *Young Nerds of Color*, and *Fabulation, or The Re-Education of Undine* by the Pulitzer Prize-winning playwright Lynn Nottage.

"If you're looking to create empathy, if you're looking to teach experience, the most powerful way of doing that is through performance arts."

– Dr. Daniel Chonde

Chonde's experience at MIT as an undergraduate and PhD student was crucial to developing his unique perspective on the connections among performance, healthcare, and social justice. As a physics major minoring in theater arts, he joined MIT's improv-comedy troupe, Roadkill Buffet, and explored performance as a means of social critique as part of the theater-comedy group, The Coalition Against Racist Propaganda and Other Crimes Perpetrated by the White Man. Those early experiments in collaborative performance have stayed with him throughout his career, and Chonde's multidisciplinary outlook has led to new practices in activism. The Black Lives Matter movement brought a new sense of urgency and direction to his role at MGH; working with Mass General Hospital's Office for Equity & Community Health, he sought to ignite an awareness of the need for greater diversity and inclusion. While aiming to address standards within the medical profession, Chonde also recognized the underrepresentation of Black artists and audiences within the Boston arts community. The two worlds came together as *A Black History Month Celebration*: three days of performances that set a precedent for ongoing interactions between the arts and healthcare, inviting new and expansive interpretations of wellness.

Images: (left) HipStory's *Vitiligo*. Courtesy of the artists. (right) *Young Nerds of Color* cast members (clockwise from top left) James Ricard Milord, Jasmine Rush, Evelyn Howe, Brandon G. Green, Jade Guerra, and Alejandro Simoes are shown in a Zoom rehearsal. Credit: Dawn M. Simmons/Central Square Theater.

MIT Performing Series

Catalyst Collaborative at MIT

Dr. Daniel Chonde, Radiology Resident, Massachusetts General Hospital

COMMUNITY PARTNERS
Central Square Theater, Front Porch Arts Collective, Huntington Theatre Company, *MIT Performing* Series

Office for Equity & Community Health; Center for Diversity & Inclusion; Radiology Diversity, Equity & Inclusion Committee, Massachusetts General Hospital

Jay Scheib, Class of 1949 Professor for Music and Theater Arts, MIT

PERFORMERS
BAMS Fest, Castle of our Skins, HipStory

How Will We Live Together?

How might architectural forms offer a new kind of spatial contract? These speculative projects, debuting at the 2021 Venice Architecture Biennale, titled *How Will We Live Together?*, imagine how new public spaces might be responsive to the urgent needs of the present: disease, war, climate change, political polarization, and economic inequality. In a time of environmental and social crises, curator Hashim Sarkis, Dean of the MIT School of Architecture + Planning, calls upon architects to reimagine "a new spatial contract" that inspires better ways of co-inhabiting a shared planet.

The Center for Art, Science & Technology supported a selection of projects exhibited at the Biennale. Azra Akšamija, in collaboration with displaced Syrian refugees, humanitarian workers, and host communities in Jordan, reinvents the structure of the refugee shelter. Looking to both the past and future, Rafi Segal and Marisa Morán Jahn investigate how architecture can cultivate new forms of communalism. Rania Ghosn vividly illustrates five large-scale technological experiments to alter the climate, critically contextualizing these projects within the longer history of climate modification schemes for the benefit of the public. Cristina Parreño Alonso examines how ancient libraries were shaped by both human culture and natural catastrophes such as fire, water, and volcanic eruptions.

By envisioning new models for living together, these CAST-sponsored projects built upon MIT's long-standing history of innovation in architecture. "But more than ever, architects are called upon to propose alternatives," Sarkis says. "As citizens, we mobilize our synthetic skills to bring people together to resolve complex problems. As artists, we defy the inaction that comes from uncertainty to ask, 'What if?' And as builders, we draw from our bottomless well of optimism. The confluence of roles in these nebulous times can only make our agency stronger and, we hope, our architecture more beautiful."

In This Section

Image: *Displaced Empire* installed at the 2021 Venice Architecture Biennale. Credit: Dino Rowan/MIT Future Heritage Lab.

Tectonics of Wisdom

Excavating the material wisdom of the library

Installation: *Carbon to Rock*, How do we live together? As Emerging Communities – Exterior Interventions, 2021 Venice Architecture Biennale, Arsenale, Venice, Italy, May 22 – November 21, 2021

Installation: *Time Space Existence*, Palazzo Bembo, Palazzo Mora, and Giardini della Marinaressa, Venice, Italy, May 22 – November 21, 2021

Installation: *Public Architecture – Future for Europe*, Schusev State Museum of Architecture, Moscow, Russia, January 31 – August 23, 2020

How might the knowledge networks of libraries be understood in relation to the timescales of Earth? *Tectonics of Wisdom* tells the stories of nine ancient libraries transformed by immense environmental upheavals—from the Library of Papyri in Herculaneum, destroyed by the volcanic eruption of Mount Vesuvius, to the Assyrian Royal Library of Ashurbanipal, incinerated in a fire which serendipitously preserved the library's inscribed clay tablets.

Tectonics of Wisdom was developed within the larger frame of Transtectonics, an ongoing research project by the architect Cristina Parreño Alonso, examining the cultural, contextual, and environmental implications of architectural materiality in the era of the Anthropocene. The five canonical libraries are represented as a grid of wireframe columns, each containing a "tectonic book" corresponding to a particular library's material event: The Library of Papyri is symbolized by a book of volcanic rock, the Royal Library of Ashurbanipal by clay, Haeinsa Temple Library by wood, the Cave Library by concrete, and the House of Wisdom by resin injected with ink.

> "Each library is examined and presented as an instance of confluence of deep and shallow timelines; of geological and human time trajectories."
>
> – Cristina Parreño Alonso

Originally presented as part of an exhibition about the future of public architecture at the Schusev State Museum of Architecture in Moscow, *Tectonics of Wisdom* focuses on the typology of the library as a way of expanding architecture's temporal sensibilities. The story of each library is intertwined with geological and civilizational history; carved into a cliffside in China's Gobi Desert, the Buddhist library of the Mogao Caves was sealed for 900 years before discovery, and the books of Baghdad's House of Wisdom reportedly made the Tigris River run black with ink during the sacking of the city in 1258.

By situating these libraries in the context of urgent global challenges occurring at planetary scales of time and space, the exhibition emphasizes the material importance of libraries at a time of increasing digitization. If we understood these public spaces in the context of ancient predecessors and the history of Earth itself, how might we reconceive the value and potential of libraries as physical spaces? By looking to the past, *Tectonics of Wisdom* excavates the conceptual and design possibilities for a typology in a state of constant flux.

Images: (left) The Mogao Caves carved into a cliffside in China's Gobi Desert. Credit: Sun Zhijun/Dunhuang Academy. (right) *Tectonics of Wisdom.* Credit: Cristina Parreño Alonso.

Displaced Empire

Reimagining humanitarian design

Installation: *Displaced Empire*, 2021 Venice Architecture Biennale, Arsenale, Venice, Italy, May 22 – November 21, 2021

Imagine a near-future world in which the majority of the population has been forcibly displaced. The capital of this speculative empire is modeled on Azraq Refugee Camp in Jordan, one of the region's largest camps sheltering more than 35,000 displaced Syrians. The empire's headquarters is the *T-Serai*, a 1:1 scale textile tent constructed from intricate tapestries of discarded clothing, space blankets, and military fabrics.

This is the scenario envisaged by the MIT Future Heritage Lab, setting the scene for an art installation developed by Azra Akšamija in collaboration with MIT students, humanitarian workers, displaced Syrian refugees, and host communities in Jordan. Reflecting on surplus and scarcity in the architecture of displacement, the installation questions the dominant "basic needs" approach of humanitarian aid practices and foregrounds the cultural, emotional, and aesthetic needs of refugees.

Displaced Empire is inspired and informed by the creative work of displaced Syrians who use art and design to humanize the T-Shelter, the standardized living unit of the Azraq Refugee Camp. The T-Serai—an acronym for Textile System for Experimental Research in Alternative

Impact—draws from the rich textile heritage and mobile architecture of the MENA region, while simultaneously making use of undervalued materials. The tent's materiality amplifies different aspects of textile architecture, from pragmatic concerns such as effective insulation to the psychological and civic impact of ornament and iconographic expression. Data visualizations and augmented reality components bring further dimensions to the experience, inviting the visitor to reflect on the urgency of creative activations within humanitarian design.

"*Displaced Empire* introduces a culturally sensitive, socially inclusive, and environmentally conscious framework to humanitarian design."

– Azra Akšamija

By altering and domesticating standardized spaces of shelter, *Displaced Empire* shows how overproduction within the global textile industry can be leveraged to serve threatened communities. The process of designing and constructing the T-Serai was itself a model for transcultural collaboration; participants from across 12 countries contributed to the Future

Heritage Lab's educational workshops in Sharjah, Boston, and Zaatari, Jordan, generating a multi-directional knowledge exchange that opened new possibilities for creativity, self-determination, and the advancement of pluralism.

Images: (left and above) The modular system and decorative structure of the tent panels are inspired by historical precedents of the mobile architecture tradition of the region and are made of humanitarian textiles and discarded clothes. Credit: MIT Future Heritage Lab.
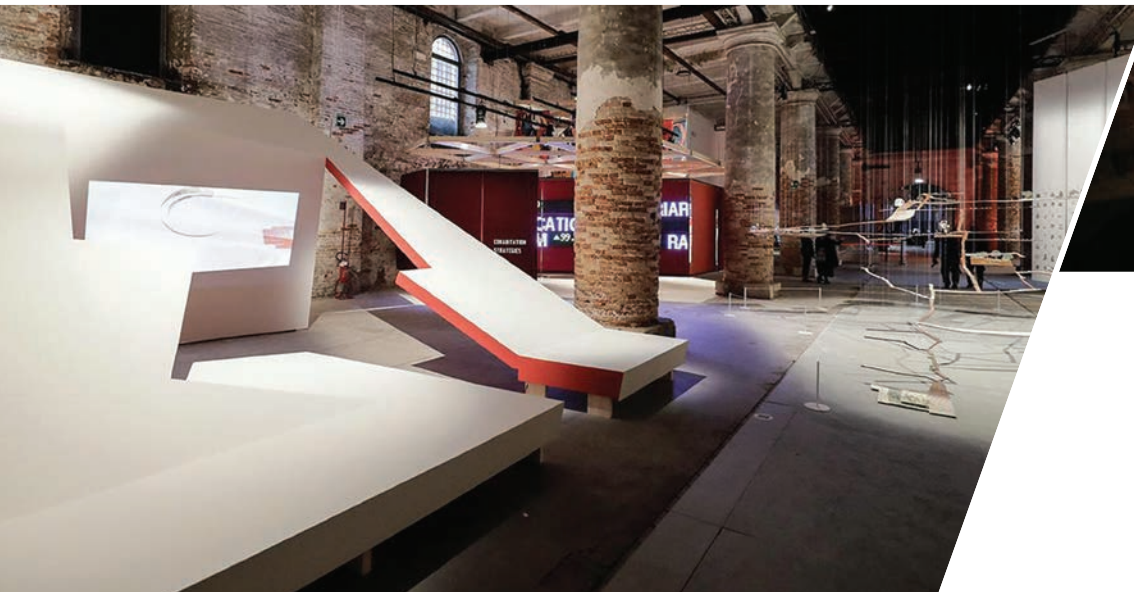
Open Collectives
Designing for mutualism

Installation: *Open Collectives*, 2021 Venice Architecture Biennale, Arsenale, Venice, Italy, May 22 – November 21, 2021

Installation: *Architecture for New Collectives*, Ostrava House of Art, Ostrava, Czech Republic, Fall 2021

Installation: *Carehaus: An intergenerational co-housing project, Human Scale Remeasured: New spatial requirements, societal demands, and economic values in architecture*, ANCB: The Aedes Metropolitan Laboratory, Berlin, Germany, January 16 – May 13, 2021

This immersive installation investigates the power and potential of the open collective, a model for cooperative action and resource sharing that takes many different forms around the world. Led by MIT's Future Urban Collectives Lab, the project investigates how such communities can be formed, organized, and strengthened by the design of physical and digital spaces.

Organized into themes of Living, Labor, Care, and Market, *Open Collectives* presents four pivotal architectural projects that offer new perspectives on economic sovereignty, housing affordability, communal self-determination, and mutual aid. *Quipu* is a micro-currency platform and physical marketplace empowering the residents of a low-income community in Colombia. *Mosaic.us* is an Arizona-based construction technology company

that aims to make home building more efficient and affordable. *Carehaus* is an intergenerational co-housing community developed with the U.S. National Domestic Workers Alliance, in which caregivers live with and care for older and disabled adults. *Communit* offers neighborhood-scale co-living in a neglected neighborhood of Haifa, Israel, known for its diverse population and history of worker housing.

"What distinguishes an open collective from the transactional 'gig economy' is an interrogation of who makes decisions, who receives access, and how wealth, power, and knowledge are shared."

— Rafi Segal & Marisa Morán Jahn

The semi-enclosed structure of the installation evokes the inclusive yet spatially defined form of an open collective, oscillating between physical and digital expressions. Collectivism is examined across different sites, scales, and programs through film, prints, interactive screens, and physical architecture models. Central to the installation is artist Marisa Morán Jahn's short film, *Forming Mutualism*, which features interviews with community partners and contemporary thought leaders exploring architecture's potential to strengthen solidarity.

Open Collectives is further expanded by a parallel crowdsourcing site that invites visitors to share their own ideas, experience, and knowledge of collectivism. By contributing to a growing global archive of ideas and anecdotes, visitors come together to form their own digital collective—one that will shape future iterations of the Biennale and the development of collectives to come.

Images: (left and right) *Open Collectives* installation at the 2021 Venice Architecture Biennale offers new perspectives on the future of work, the reputational economy, solidarity building, co-living, the elderboom, and the care crisis. Credit: Courtesy of the artists.

CAST International Exhibition and Performance Fund

Marisa Morán Jahn, Cofounder and President, Studio REV

Greg Lindsay, Director of Applied Research, NewCities

Rafi Segal, Director, MIT Future Urban Collectives Lab and Associate Professor, School of Architecture + Planning, MIT

Sarah Williams, Director, MIT Civic Data Design Lab and Associate Professor, School of Architecture + Planning, MIT

The Planet After Geoengineering
Speculative visions of Earth system interventions

Installation: *The Planet After Geoengineering*, 2021 Venice Architecture Biennale, Giardini della Biennale, Venice, Italy, May 22 – November 21, 2021

Rania Ghosn and El Hadi Jazairy's design research practice, DESIGN EARTH, gives visual and narrative form to geoengineering: the controversial new technologies that seek to counteract the effects of climate change by deliberately intervening in Earth systems.

Climate scientists and policymakers are deeply divided over whether to pursue geoengineering strategies such as reflecting the Sun's rays back into space and mining the sky of carbon. In a series of 25 newly commissioned large-scale drawings and narratives, *The Planet After Geoengineering* imagines the possible trajectories of climate manipulation technologies in the form of five speculative geostories: Petrified Carbon, Arctic Albedo, Sky River, Sulfur Storm, and Dust Cloud. The

scenarios—which include visions of sulfurous dust clouds and cloned woolly mammoths—are situated aesthetically and contextually within a wider history of interventionist experiments such as 19th-century rainmaking machines and Cold War weather modification schemes. In addition to the series of drawings, the project also includes an animation with music by Christine Southworth and Evan Ziporyn, and a graphic novel featuring essays by geographer Kathryn Yusoff, theorist Benjamin Bratton, and climate intervention researcher Holly Jean Buck.

"How do we engage speculatively—and make public—such interventions in Earth systems?"

– DESIGN EARTH
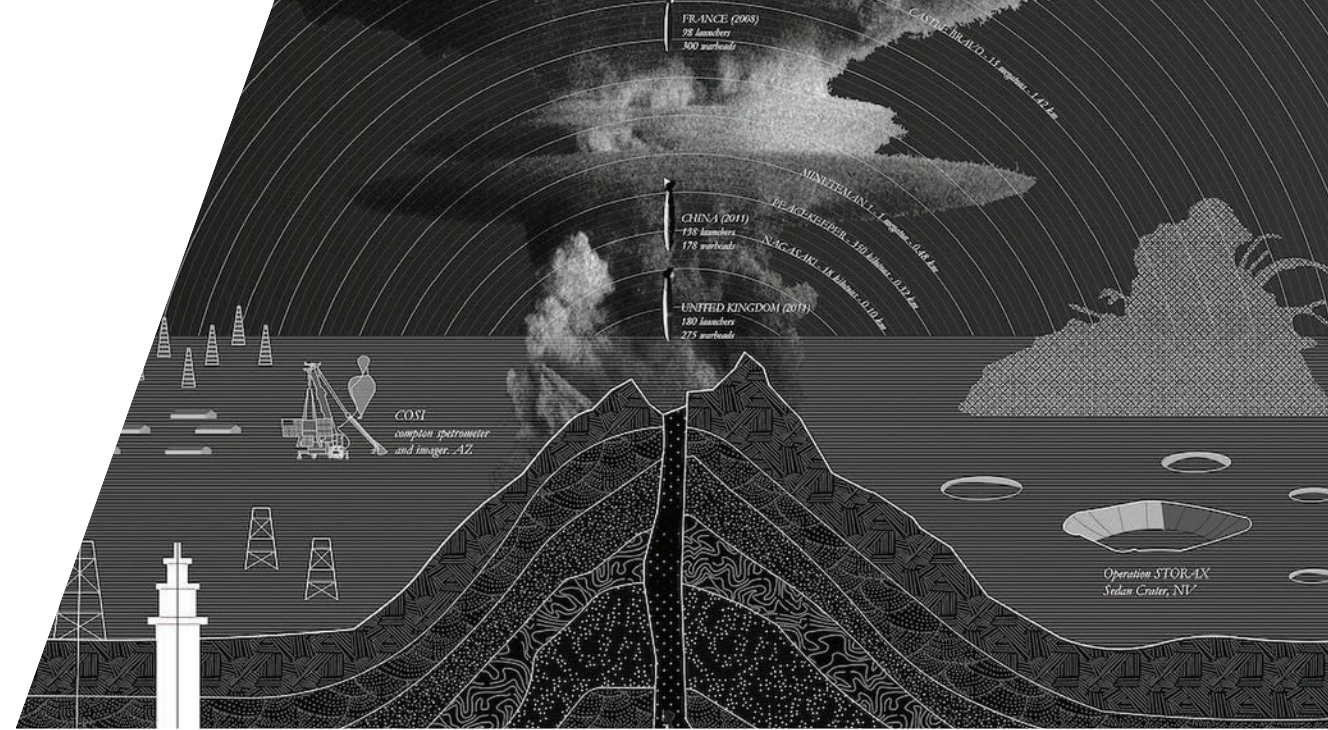
By making accessible the specialist discourse of geoengineering, the project encourages the viewer to engage critically and creatively with the potential outcomes of emerging technologies, offering a method of communication that can be applied across multiple different fields. How can we judge the efficacy and potential danger of technologies which directly intervene in Earth systems? What might it be like to live alongside such interventions, and what particular definition of "survival" do they propose? Image making and storytelling become tools of speculative research and debate, informing and impacting the direction of shared futures.

Images: (left) Installation view of *The Planet After Geoengineering* at the 2021 Venice Architecture Biennale. A series of five stories is displayed in a storyboard assembled into one planetary section from the deep underground to outer space. Credit: DESIGN EARTH. (right) "Sulfur Storm," *The Planet After Geoengineering,* 2021. Operation Sulfur Storm detonates the Cold War nuclear arsenal in the magma chambers of tropical volcanoes. Credit: DESIGN EARTH.

CAST International Exhibition and Performance Fund

Benjamin Bratton, Director, Center for Design and Geopolitics, University of California, San Diego

Holly Jean Buck, Assistant Professor, Department of Environment and Sustainability, University at Buffalo

Rania Ghosn, Associate Professor, School of Architecture and Planning, MIT

El Hadi Jazairy, Assistant Professor of Architecture, University of Michigan and Research Scientist, School of Architecture and Planning, MIT

Christine Southworth, Cofounder and Artistic Director, Ensemble Robot

Kathryn Yusoff, Professor of Inhuman Geography, Queen Mary University of London

Evan Ziporyn, Kenan Sahin (1963) Distinguished Professor of Music and Theater Arts and Faculty Director of the Center for Art, Science & Technology, MIT

Memory Work / The Radical Archive

Two artists turned their attention toward histories of dissent, preserving the radical voices of those who challenged the status quo. Historian and MIT professor Lerna Ekmekçioğlu unearthed the stories of trailblazing Armenian feminists in a virtual exhibition and digital archive of their writings, letters, and postcards. "This is a project of recovery and reclamation," Ekmekçioğlu says. Multimedia artist Lara Baladi, in her web-based art project *Anatomy of a Revolution*, archived the more recent past: global protest movements, from the Egyptian revolution in Cairo's Tahrir Square to the Black Lives Matter protests across the United States. On a more elegiac note, artist Judith Barry created a multimedia installation centered upon the long-shuttered video chain Mondo Kim's, an enchanting homage to the cinematic medium, which reconstructed the hushed palaces of spectatorship. Through data visualizations, online archives, and multimedia experiments, these scholars and artists explore how histories, small and large, are preserved, displayed, and remembered for the future.

In This Section

All the Light That's Ours to See

Anatomy of a Revolution

Twelve Faces of Armenian Feminism

Image: Installation view of Judith Barry's *All the Light That's Ours to See*, exhibited at Lumiar Cité, Lisbon, 2020. ©Judith Barry Studio.

All the Light That's Ours to See

Investigating technologies of perception

Exhibition: *All the Light That's Ours to See*, Lumiar Cité, Associação Maumaus, Rua Tomás del Negro, 8A, 1750-105 Lisbon, Portugal, September 19 – November 22, 2020

Virtual Event: Judith Barry in conversation with Giovanbattista Tusa, moderated by Jürgen Bock, Associação Maumaus, November 18, 2020

likewise, archaic forms are shown to contain the seeds of contemporary digital practice, including internet culture, cybernetics, robotics, and artificial intelligence.

"If the montage and collage were the image operations that characterized the 20th century, what new forms will the algorithms and computer languages of the 21st century produce? Will they allow for the formlessness required for an endlessly evolving becoming? Or will everything succumb to the logic of the database?"

– Judith Barry

As audience behaviors change in response to new viewing technologies, Judith Barry records those developments in real time; standing between screens, the viewer becomes hyper-aware of their own reactions to the flow of images, recognizing the subtle perceptual shifts that occur as we adapt to our surroundings. *All the Light That's Ours to See* is the history of our own receptivity—as viewers, changemakers, and participants in stories told at the speed of light.

Images: (left and right) Installation views of All the Light That's Ours to See, including a two-channel video-sound installation with custom tables, photographs, and books. Exhibited at Lumiar Cité, Lisbon, 2020. ©Judith Barry Studio.

Centered upon the story of the rise and fall of the legendary New York video rental chain, Mondo Kim's, *All the Light That's Ours to See* is an elegiac meditation on changing viewing habits and the ways we are transformed by evolving media.

In this two-channel installation—a bricolage of architecture, performance, and new media methodologies—we follow Mr. Yongman Kim's quest to find a home for his collection of 55,000 films. A palimpsest of images appears on adjacent screens; the viewer is led between architectural spaces dating from the medieval period to the present day, navigating anatomy theaters and factories, movie palaces and museums—environments that reveal how technologies of presentation and perception have informed social interactions across time.

Sited at the intersection of lived experience and digital representation, *All the Light That's Ours to See* allows the viewer to intuitively connect historical moments and reflect on the flux of lost media histories. Just as the video rental market domesticated movie watching, so too has the introduction of streaming and social media shifted our relationship to the big screen;

CAST International Exhibition and Performance Fund

Judith Barry, Professor and Director, Program in Art, Culture, and Technology (ACT), MIT

VIRTUAL EVENT PARTICIPANTS

Jürgen Bock, Director, Associação Maumaus

Giovanbattista Tusa, Researcher in Philosophy and Ecology, Universidade Nova de Lisboa

Anatomy of a Revolution

An A-to-Z of revolutionary practice

Commemorating the tenth anniversary of Egypt's Tahrir Square uprising and a decade of unprecedented global social movements, *Anatomy of a Revolution* is a web-based art project by the Egyptian-Lebanese artist, archivist, and educator, Lara Baladi. Reimagined as an interactive online abecedary, the project draws upon the archive of digital data that Baladi has been collecting since first taking part in the demonstrations of 2011.

"Anatomy of a Revolution is at once an artistic and educational project: a 'lesson in history.' "

– Lara Baladi

Oscillating between Arabic and English, the abecedary intertwines art historical references with the contemporary iconography of protest, inviting visitors to freely scroll through a bilingual A-to-Z of definitions, concepts, anecdotes, and methodologies for sustained social change. By subverting the language and format of 1950s propagandist educational tools, this visual narrative illustrates and excavates the evolving vocabulary of revolutions across time, focusing specifically on Egypt's 2011 uprising; the 2019 protests in Bolivia, Hong Kong, Lebanon, and Sudan; and the 2020 Black Lives Matter protests across the United States.

The project is an expansion of Baladi's previous work creating data visualizations of online archives about the Egyptian uprising, and *Anatomy of a Revolution* marks the culmination of *Vox Populi, Tahrir Archives*, a tribute to the catalytic events in Tahrir Square in 2011 and their sustained impact upon sociopolitical movements today. As a study of specific and localized instances of activism, Baladi's work can be understood as a meditation on the principle inherent to all revolutions: the ongoing quest for freedom.

Images: (left) A mural photographed in Tahrir Square, July 2012. Credit: Lara Baladi. (right) A video still from *Anatomy of a Revolution* demonstrates the analogies between the iconic artwork, Rembrandt's *The Anatomy Lesson of Dr. Nicolaes Tulp,* and a photograph of the display of the body of Argentinian Communist revolutionary leader Ernesto "Che" Guevara on the day following his execution in 1967. Credit: Lara Baladi.

Twelve Faces of Armenian Feminism
Disclosing hidden feminist histories

Virtual Exhibition: *Twelve Faces of Armenian Feminism, 1860s to 1960s,* Spring 2022

Twelve Faces of Armenian Feminism highlights 12 pioneering Armenian women who radically challenged the gender norms of their times. Focusing on the period between 1860 and 1960, the virtual exhibition and interactive multimedia archive is curated by Professor Lerna Ekmekçioğlu, building upon research conducted in collaboration with Dr. Melissa Bilal.

As the author of the book, *Recovering Armenia: The Limits of Belonging in Post-Genocide Turkey*, Ekmekçioğlu has played an important role in disclosing the daily experiences of Armenians who stayed in Turkey in the immediate aftermath of the Armenian Genocide and World War I. In this new project, Ekmekçioğlu draws attention to the women writers, educators, translators, journalists, editors, and revolutionaries whose lives are rarely recounted—*Twelve Faces of Armenian Feminism* is a way of bringing those stories to light, narrated through material culture and digital storytelling.

Samples from published and unpublished texts, letters, postcards, photography, and artifacts such as reading glasses and needlework act as physical traces of radical work, while animated biopics and oral history video interviews provide accessible points of entry to the extensive archive. Poetry set to music and dramatized readings bring a new living presence to literary works too often erased from student syllabi and dominant narratives of Armenian culture.

"This is a project of recovery and reclamation. We focus on 12 unsung changemakers—all feminists—in order to restore them to their proper places in history and popular consciousness."

– Lerna Ekmekçioğlu

By inspiring viewers to rediscover the stories lost within national mythmaking, *Twelve Faces of Armenian Feminism* sparks new modes of discourse and reclaims a foundation of feminist practice on which to build new futures. To quote an idiomatic Armenian phrase, "The pen, the ladle, and the needle always were by her side"— what new compositions might emerge in the world of today, where feminism itself is contested territory?

Images: (left) Collage of materials presented in *Twelve Faces of Armenian Feminism* includes a photograph of Srpouhi Dussap (1841–1901, Constantinople), the first Armenian woman novelist, and covers of her books. Credit: Lerna Ekmekçioğlu.

(right) Photograph of Hayganush Mark who, along with her comrades at her journal *Hay Gin* (Armenian women), advocated women's emancipation. (bottom) Unpublished correspondence between women writers. Credit: Lerna Ekmekçioğlu.
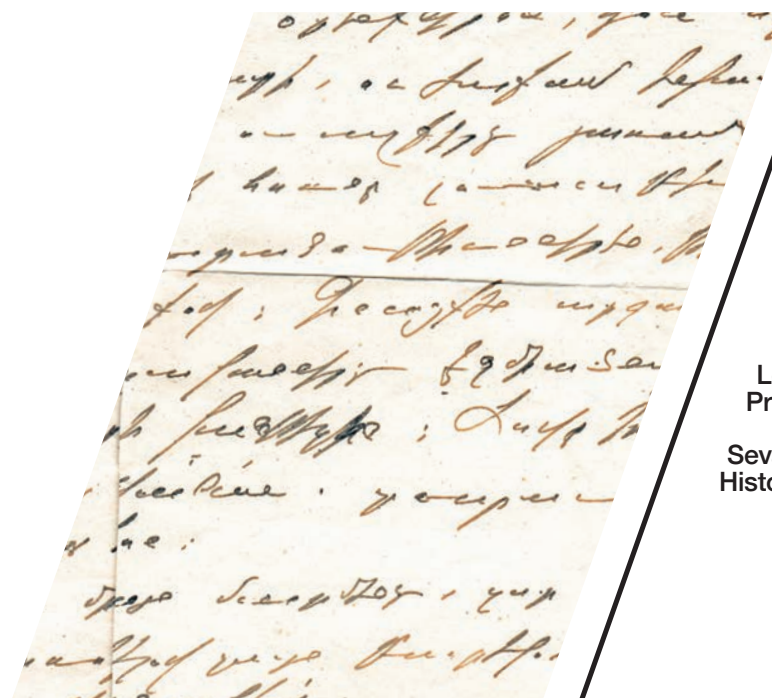
Hourig Attarian, Assistant Professor, Program in English and Communications, American University of Armenia

Melissa Bilal, Distinguished Research Fellow and Lecturer, Department of Ethnomusicology, University of California, Los Angeles; Visiting Scholar, History, MIT (2017–18)

Lerna Ekmekçioğlu, Associate Professor, History, MIT

Sevan Injejikian, Curator and PhD Candidate, History of Art, University College London

Performance as Research / Embodied Knowledge

Though Descartes famously proclaimed, "I think, therefore I am," recent research and scholarship have turned to the importance of the body in understanding how cognition functions. How might embodied knowledge present new ways of comprehending our environments and ourselves?

In these projects, artists, choreographers, dancers, and actors investigate how dance making and performance offer unique ways of knowing and being in the world. In Adesola Akinleye's course, Choreographing the City, the artist-scholar explored with students how dance can function as a mode of place making, a kind of civic data that allows for new possibilities in urban planning and design. The dance troupe Lion's Jaw presented a series of discussions and performances that examined the idea of queer futures, and how dance can work as a mode of resistance and community building. Actor, director, and writer Lisa Dwan, who was trained as a dancer and is now the world's foremost interpreter of Samuel Beckett, returned to campus to discuss how her highly physical theatrical performances translated to virtual spaces.

In navigating themes of community, rebellion, place, memory, and language, these artists explore the body as a vessel for knowledge, a tool for understanding, and a medium for creativity.

In This Section

Choreographing the City

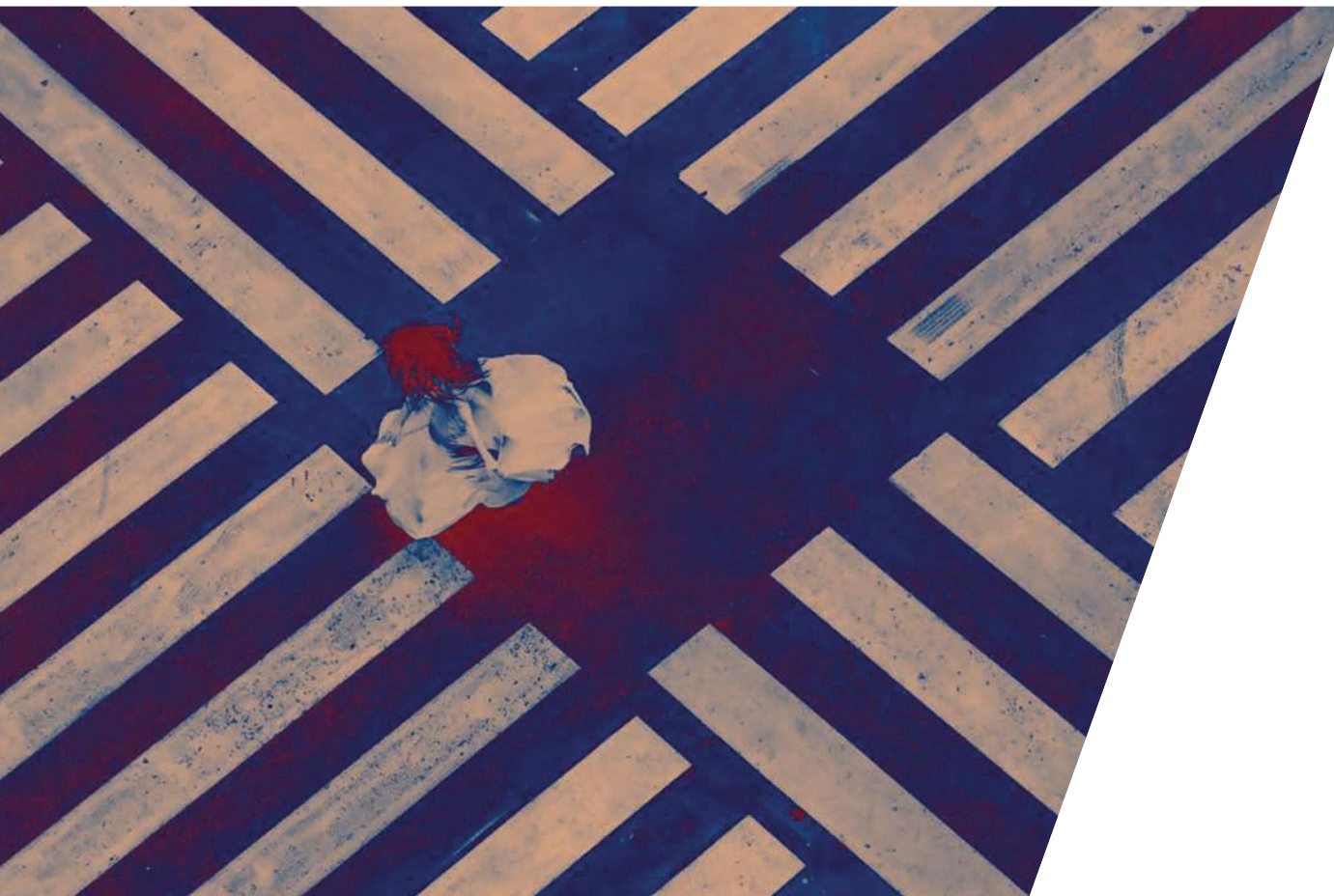*Queer Futures*: Lion's Jaw Festival of Dance and Performance

Finding Connection Through Mediated Performance: A Conversation with Lisa Dwan

Image: Participants in the 2016 Lion's Jaw Festival. © The Fleet NYC. Courtesy of Lion's Jaw Festival.

Choreographing the City
Shaping urban spaces through dance

Class: 4.314/5 Advanced Workshop in Artistic Practice and
Transdisciplinary Research: Choreographing the City, Fall 2020

Guest artists, including the choreographers Dianne McIntyre and Liz Lerman, took part in *Choreographing the City Morning Conversations*, which were recorded as a new podcast series. Other experimental practices included weekly movement sessions featuring Gyrotonic and dance score methodologies, and interactive urban dance workshops led by DancingStrong Movement Lab. Conducted virtually, these activities became ways of reigniting the creative agency of the body during a year of physical distancing.

> "How do we become attentive to a community's emotional, cultural, and corporeal memory in order to move beyond the scripted spaces and codified routes?"
>
> – Adesola Akinleye

Through the lens of civic choreography, infrastructure is reframed as an art, and the practice of urban planning becomes wholly embodied. Ultimately, the goal of Choreographing the City is to open up pathways of communication between urban designers and inhabitants; by redefining cities as collaborative entities shaped through somatic knowledge, individuals and communities are equipped with new tools for describing and transforming the places in which they live.

Image: Cover of *Dance, Architecture and Engineering,* written by Adesola Akinleye and published by Bloomsbury, 2021.

Adesola Akinleye, CAST Visiting Artist and Research Affiliate, Program in Art, Culture, and Technology, MIT

John Bingham-Hall, Director, Theatrum Mundi

Ellie Cosgrave, Associate Professor of Urban Innovation and Director, University College London Urban Innovation Laboratory

DancingStrong Movement Lab

Liz Lerman, Choreographer and Founder, Liz Lerman Dance Exchange

Hūfanga 'Ōkusitino Māhina, Professor of Tongan Studies, Founder and Director, Vava'u Academy for Critical Inquiry and Applied Research

Arianna Mazzeo, Visiting Professor of Practice in Design, Art, and Technology, Harvard University

Dianne McIntyre, Dancer and Choreographer

Scott L. Pratt, Professor of Philosophy, University of Oregon

Richard Sennett, Chair, Urban Initiatives Group – UN Habitat, and Chair, Theatrum Mundi

Gediminas Urbonas, Associate Professor, Program in Art, Culture, and Technology, MIT

How might the motion of a dancing body allow us to reshape urban spaces? Artist-scholar Adesola Akinleye interprets choreography as a "three-dimensional language" that can contribute to impactful discussions about urban design. Her residency at MIT investigates how dance-based research and cross-disciplinary creative collaboration can generate new techniques, lexicons, and conversations to foster progressive thinking about the future of cities.
Working closely with Professor Gediminas Urbonas, Akinleye developed a series of lectures, performances, workshops, and class discussions, proposing ways that somatic experience of a city might be captured as a form of data—comparable to the objective spatial data identified by geographic information systems. In addition to collaborating with researchers and students in the Department of Urban Planning; the Program in Art, Culture, and Technology; and the MIT Media Lab, Akinleye also invited guest artists and scholars from Theatrum Mundi, the research organization founded by the urbanist and musician Richard Sennett, which explores the intersection of performance and the city.

Queer Futures: Lion's Jaw Festival of Dance and Performance

A virtual environment for cooperation and self-care

Virtual Event Series: *Queer Futures: Re-orientations for Performance, Queer Arrivals, and Pursuits Through and After the Pandemic*, October 8 – 10, 2020

The experience of the pandemic has called into question conventions of physical proximity and daily intimacy. *Queer Futures*—a series of three discussions exploring new orientations for performance—was a way of recalibrating personal and collective relationships to the body at a time of unprecedented social and spatial dislocation.

"That's the invitation of Lion's Jaw—how do we keep assembling in unexpected ways?"

– Thomas F. DeFrantz

Facilitated by Thomas F. DeFrantz and co-presented by *MIT Performing* and the Lion's Jaw Festival of Dance and Performance, the discussions brought together educators, choreographers, and performers to share ideas about how to create supportive spaces for social change. Over the course of three days, the discussions formed a virtual environment for cooperation and self-care, radically destabilizing the relationship among audience, performer, and place. Presented as a method of collaborative research and a live performance in its own right, each discussion brought a new dynamism to questions of identity and bodily

knowledge; participants exchanged personal experiences and emerging ideas, touching on issues such as the compromised domesticity of working from home, the physical and emotional risks of artistic authenticity, and the healing potential of collective self-expression.

This commitment to re-orienting conventional systems and power dynamics is central to the ethos of Lion's Jaw, which seeks to disassemble hierarchy and consumerism in the arts. Founded in 2015, the performance festival emerged from the practices of the New Movement Collaborative, an organization created to support, interrogate, and cultivate contemporary dance in Boston and throughout the United States. Together with *MIT Performing*, Lion's Jaw advocates progressive approaches to prototyping new contemporary performance, deconstructing established discourse, and working closely with communities to reveal new ways of moving through the world.

Images: (left and right) Lion's Jaw Festivals held in person pre-pandemic fostered the exchange of ideas through daily rigorous technical training and interdisciplinary exploration. Lion's Jaw was built to bring artists together, to work in close proximity, and to learn from one another. Credit: © The Fleet NYC, courtesy of Lion's Jaw Festival.

MIT Performing Series

Thomas F. DeFrantz, Chair of African and African American Studies, Professor of Dance and Theater Studies, Duke University

Sarah Mae Gibbons, Cofounder, Lion's Jaw Festival of Dance and Performance

Zavé Martohardjono, Independent Artist

Eroca Nicols, Independent Choreographer

Joseph M. Pierce, Associate Professor, Department of Hispanic Languages and Literature, Stony Brook University

Jumatatu M. Poe, Co-Director, idiosynCrazy productions

Jess Pretty, Independent Choreographer

Jay Scheib, Class of 1949 Professor for Music and Theater Arts, MIT
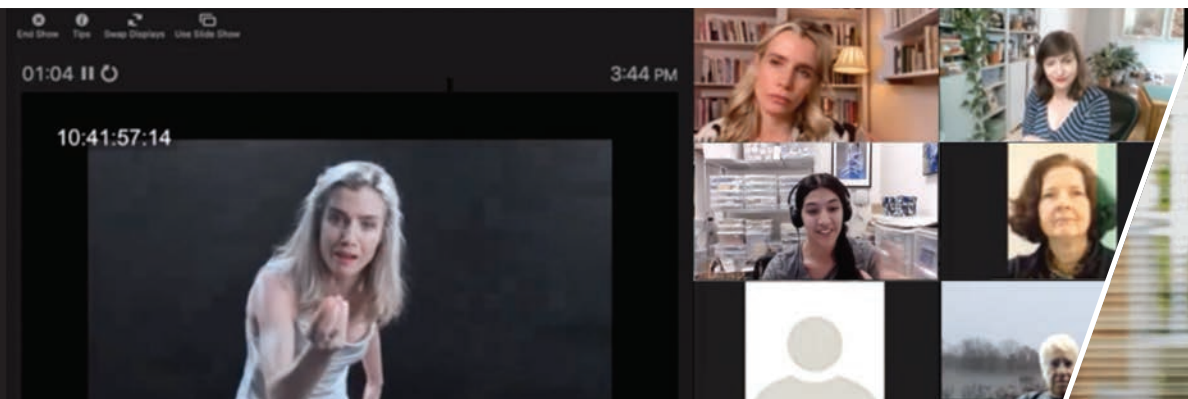
Joy Mariama Smith, Independent Artist

Jared Williams, Director and Cofounder, Lion's Jaw Festival of Dance and Performance

Finding Connection Through Mediated Performance: A Conversation with Lisa Dwan

Translating performances for stage and screen

Virtual Event: *Finding Connection Through Mediated Performance: A Conversation with Lisa Dwan*, May 14, 2021

As the world of theater enters a new era of hybrid digital and physical programming, the acclaimed Irish actress, producer, and director Lisa Dwan shared her reflections on the process of developing performances for the screen. In an online conversation, *Finding Connection Through Mediated Performance,* Dwan assessed the limits and opportunities for film and virtualized theater, referring to her recent screen adaptation of *Pale Sister,* Colm Tóibín's retelling of Sophocles' *Antigone*; her role in the BBC television series, *Bloodlands*; and her ongoing excavations and reinterpretations of the work of playwright Samuel Beckett.

"We must infuse metaphor into every gesture, to give it purpose, to make it live."

– Lisa Dwan

Celebrated for performances which are both intensely physical and deeply cerebral, Dwan is considered one of the greatest modern interpreters of Beckett. Her experimental lecture, "A Body of Beckett," was presented for the inaugural 2018–19 *MIT Performing* Series, in which she examined the under-recognized influence of movement and dance in the playwright's work. Weaving together sections from selected Beckett texts with highly physical demonstrations and her own musings on his ideas, Dwan's lecture proposed a new approach to radical close reading.

As the CAST Mellon Distinguished Visiting Artist, Dwan deepened her explorations at the intersection of text, live performance, and technology, working with faculty members across the Media Lab, Literature, and Theater Arts departments to examine the idea of "the body as media." For Dwan, originally trained as a ballerina, dance is a communicative tool and a form of thinking; gesture is infused with metaphor, and language is always at the brink of breakdown. The body becomes a site to resolve those tensions, while at the same time revealing the fragility of meaning making—a process which requires careful mediation, whether performed on stage or translated to screen.

Images: (left) Screenshot of the virtual presentation, *Finding Connection Through Mediated Performance; A Conversation with Lisa Dwan*. (right) Lisa Dwan in rehearsal for *Pale Sister,* a collaborative project with Colm Tóibín offering a new take on the classic Greek tragedy *Antigone* that premiered at the Gate Theatre in October 2019. Credit: Ros Kavanaugh.

MIT Performing Series

Lisa Dwan, CAST Mellon Distinguished Visiting Artist

Jay Scheib, Class of 1949 Professor for Music and Theater Arts, MIT

"Unfolding Intelligence: The Art and Science of Contemporary Computation"

In the popular imagination, artificial intelligence is either a salve or a menace: a bright panacea to optimize our brains and solve our problems, or a cold interloper threatening our livelihoods, our democracy, and our humanity itself. In bringing together artists, humanists, scientists, and engineers, the MIT CAST symposium, "Unfolding Intelligence: The Art and Science of Contemporary Computation," convened by D. Fox Harrell, Stefan Helmreich, Caroline A. Jones, and William Lockett, challenged this binary view to investigate new ways of thinking about computation and its ramifications for art and society.

The weeklong virtual gathering explored how AI might provide new models of the world, offer new forms of perception and creative expression, and create a more equitable and just future. As the almighty algorithm has permeated every aspect of contemporary existence, the symposium offered critical perspectives across a diverse range of fields, from astrophysics to aesthetics. In the course of the conference, artists and scholars challenged basic assumptions—What is intelligence? Whose intelligence?—to think in radical new ways about what computers can do, and how we as a society might learn, create, and act alongside them.

Artificial intelligence systems, far from cold automatons, can be expressive, malleable, radical, and surprising. Rather than compromise our humanity, AI may in fact offer new ways of perceiving, thinking, feeling, and being beyond our natural limitations, and in the process deepen our relationships with the planet and one another. By imagining what other worlds might be made by and with computers, we might find ourselves somehow more human.

2021 CAST Symposium Partners:
MIT Center for Advanced Virtuality
MIT List Visual Arts Center
MIT Transmedia Storytelling Initiative
MIT Trope Tank

Image: Screenshot of *The Invisible College.* Credit: Matthew Ritchie.

The Invisible College
Discovering the secret life of MIT

and the physics of sight. Masked avatars representing quark and antiquark particles called "Red," "Green," and "Blue" wandered a post-apocalyptic setting, accompanied by the haunting score by Evan Ziporyn and Shara Nova. As these mysterious figures roam the almost deserted MIT campus, their activities might be read both as a meditation on the role of the masked persona in gaming and popular culture and as a response to the masked world that defined 2020 during the COVID-19 pandemic.

The final iteration, *House of Illusion*, features the avatars reenacting scenes from the film in a large-scale public augmented reality work,

completing the cycle from site information to site-specific game, then to informational film, and finally back to the original physical site. In exploring the Institute as both an information space and a physical one, Ritchie captures those states of turbulence, chaos, and indeterminacy—the rush between classes or the blurry moment before a picture sharpens into legibility—the liminal, sketchy zones that, as he says, create "the most generative space for the radical rethinking of reality."

Images: (all) Screenshots of *The Invisible College*. Credit: Matthew Ritchie.

Artist Matthew Ritchie's multipart transmedia artwork, *The Invisible College*, was inspired by new developments in artificial intelligence, collaborations with a multidisciplinary team of MIT faculty and students, and Sir Francis Bacon's unfinished 1626 utopian novel, *New Atlantis*, which proposed the first description of the scientific method, ultimately becoming the model for research institutions like MIT.

The project took as its subject the "invisible college" of MIT: the informal and unseen interactions, discussions, and ideas that form the lifeblood of the institution. The iterative project incorporated the many dimensions of the Institute—social, material, intellectual, and technological—from the informal conversations to the new technologies being developed in the labs. What emerged was an ever-evolving reflection on the nature of inquiry, embodied in a science-fiction detective story set in an evocative, almost mythological version of MIT.

The first part of *The Invisible College* manifested in early 2020 as a site-specific VR game, *House of Strangers*, using Generative Adversarial

"What's masterful about Matthew's project is how he continuously incorporated the emerging technologies and circumstances he discovered at MIT to create mutating artforms."

– Leila W. Kinney

Networks (StyleGAN and CycleGAN) and artificial intelligence (GPT-2) to generate imagery and content and featuring music by Evan Ziporyn. When the campus was closed due to the COVID-19 pandemic, the VR game migrated across media to become a second work, *Latent Island*, which nested footage from the GANs and the VR game inside 360-degree video footage of the empty campus.

The third iteration of the project, *Color Confinement*, premiering as part of the CAST *Unfolding Intelligence* symposium, was also made remotely using "actors" derived from a video game engine. *Color Confinement* was a melancholy study of genre play, world building,

Markus J. Buehler, Jerry McAfee (1940) Professor in Engineering and Head, Department of Civil and Environmental Engineering, MIT

Peter H. Fisher, Professor of Physics and Head, Department of Physics, MIT

Peter L. Galison, Pellegrino University Professor of the History of Science and of Physics, Harvard University

Caroline A. Jones, Associate Dean for Strategic Initiatives, School of Architecture + Planning and Professor of History, Theory, and Criticism of Architecture and Art, MIT

Leila W. Kinney, Executive Director of Arts Initiatives and CAST, MIT

Shara Nova, Musician

Matthew Ritchie, 2018–21 Dasha Zhukova Distinguished Visiting Artist, MIT

Nick Roth, Animator

Sarah Schwettmann, PhD Candidate, Department of Brain and Cognitive Sciences, MIT

Sarah Wolozin, Director, MIT Open Documentary Lab, MIT

Chi-Hua (Jonny) Yu, Postdoctoral Associate, Laboratory for Atomistic and Molecular Mechanics, MIT

Evan Ziporyn, Kenan Sahin (1963) Distinguished Professor of Music and Theater Arts and Faculty Director of CAST, MIT

Generative Unfoldings

An online exhibit of code-based art explores iterative processes

Virtual Exhibition and Reception: *Generative Unfoldings*, "Unfolding Intelligence: The Art and Science of Contemporary Computation," April 1, 2021

How can artist-programmers working in the field of computer-generated art make unique contributions to the current discussion of artificial intelligence? This was the question posed by curator Nick Montfort in an open call for sketches and prototypes for the born-digital exhibition, *Generative Unfoldings*.

Juror and MIT alum Lauren Lee McCarthy describes generative art as "different from a video or an image, where it's a closed work that you could loop or view multiple times, but it always stays the same. With a generative work, there's a quality of liveness, where it's always changing." Because the works are created with live running software, the piece will always be different each time it is seen.
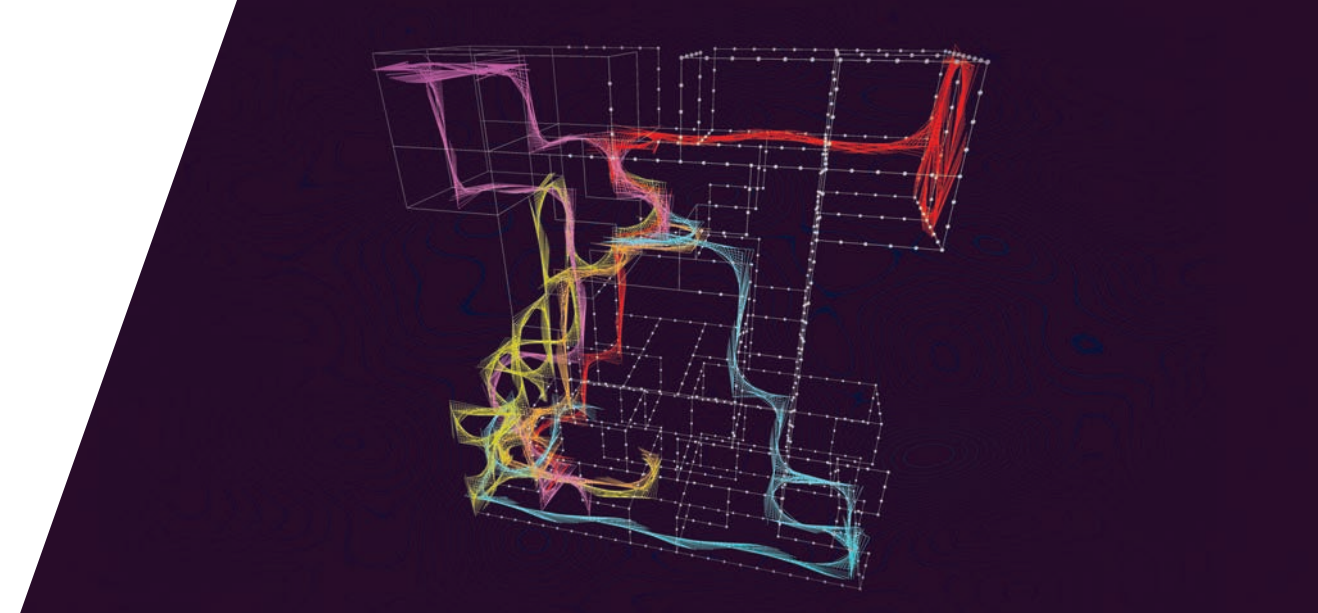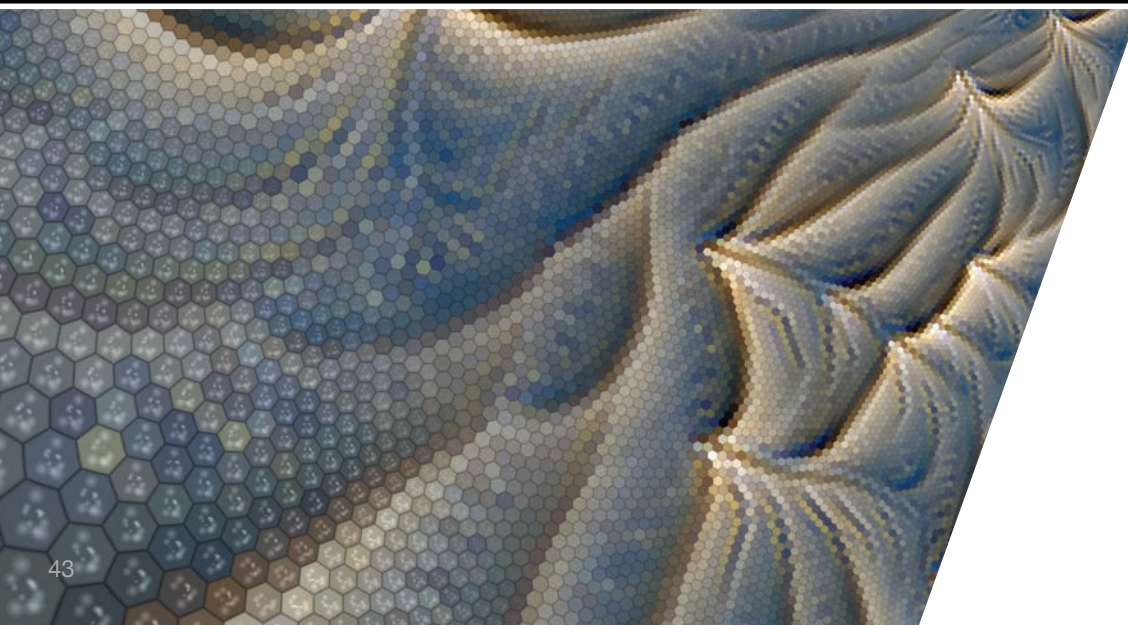
> ## "Generative art, in the most basic sense, could be thought of as art that's made with code and that is constantly generating or constantly making a new form with itself."
>
> ## – Lauren Lee McCarthy

we are going to have to break the systems in many ways. And art has always done that. And that's why—because art and technology really do co-evolve with each other."

Images: (left, top) Screenshot of Can the Subaltern Speak? *by Behnaz Farahi. (left, bottom) Screenshot of* Hexells *by Alexander Mordvintsev. (right, top) Screenshot of* Pac Tracer *by Andy Wallace.*

The resulting commissioned works represented an exciting diversity of topics and approaches, spanning a wide range of media and techniques and challenging common ideas about what generative art looks like. The artworks ranged from the poetic to the political, from highly formal pieces to those that tackled social issues. *Generative Unfoldings* was an art exhibit, but also "a free software exhibit that allows people to study, fork, distribute, or rework any of the projects that have been done in it," says Montfort. The works appear both as *Generative Unfoldings (Screen)*, an exhibition of in-browser artworks, and as *Generative Unfoldings (Code)* in an open-source GitHub repository. Making the exhibit open-source builds community and helps to create a more collaborative and inclusive future, jurors say.

The artworks used iterative and evolving approaches while leveraging the expressive powers of technology. "We need to constantly be including arts and humanities and force the machine to think outside the box. And I feel like this is the perfect moment. People are really starting to be aware of the systems they participate in because of the pandemic, because technology has been the crucial platform for this whole perspective," says juror Sarah Rosalena Brady. "I think that's really important because

FEATURED ARTISTS
Qianxun Chen & Mariana Roa Oliva, Hye Min Cho, Matt DesLauriers, Karen ann Donnachie & Andy Simionato, Encoder Rat Decoder Rat (Dylan Box & M Kuznetsov), Juan Manuel Escalante, Behnaz Farahi, Maja Kalogera, Arwa Mboya, Alexander Mordvintsev, Ágoston Nagy, Philipp Schmitt, Lee Tusman, and Andy Wallace

JURY
Sarah Rosalena Brady, Assistant Professor of Art, Computational Craft and Haptic Media, UC Santa Barbara

D. Fox Harrell, Professor of Digital Media and Artificial Intelligence, MIT Comparative Media Studies Program/Writing and MIT Computer Science and Artificial Intelligence Laboratory (CSAIL); and Director of the MIT Center for Advanced Virtuality

Lauren Lee McCarthy, Associate Professor of Design Media Arts, School of the Arts and Architecture, UCLA

Parag K. Mital, Chief Technology Officer and Head of Research, Hypersurfaces

Nick Montfort, Professor of Digital Media, Comparative Media Studies/Writing, MIT

Deep Time & Intelligence

How different forms of perception suggest new ways that AI might learn

Composer and musician Holly Herndon's "AI baby" Spawn is fed with communally sourced data sets and performs alongside Herndon in her vocal ensemble. In this work, Herndon probes the relationship between the art form and its source material, contrasting "sampling" with the idea of "spawning." Whereas the former often appropriates from its sources without adequate credit, Herndon asserts, the latter consciously attempts to properly accredit and build upon the communal knowledge of the past. Material scientist Markus J. Buehler also collaborates with AI tools to create music. By sonifying protein sequences, the basic structures of life on Earth, Buehler looks to shed light on our primordial past—what might have happened during the birth of the universe. "The creation of music is really a deeply human experience," Buehler said. "It's a way of mapping out memory of deep time."

From a composer and musician who sees the training of AI as a novel ritual form to a musicologist of paleolithic sonic intelligence and a computer scientist's account of multimodal sensory training inputs, this panel resituated AI within the long durée of thinking and microbursts of ingenuity called *training* or *learning*.

Images: (left) Screenshot from *VirtualHome,* a multi-agent household simulator. Courtesy of Antonio Torralba and the *VirtualHome* team. (right) 3D printed model of a spider web. Courtesy of Markus J. Buehler and Isabelle Su.
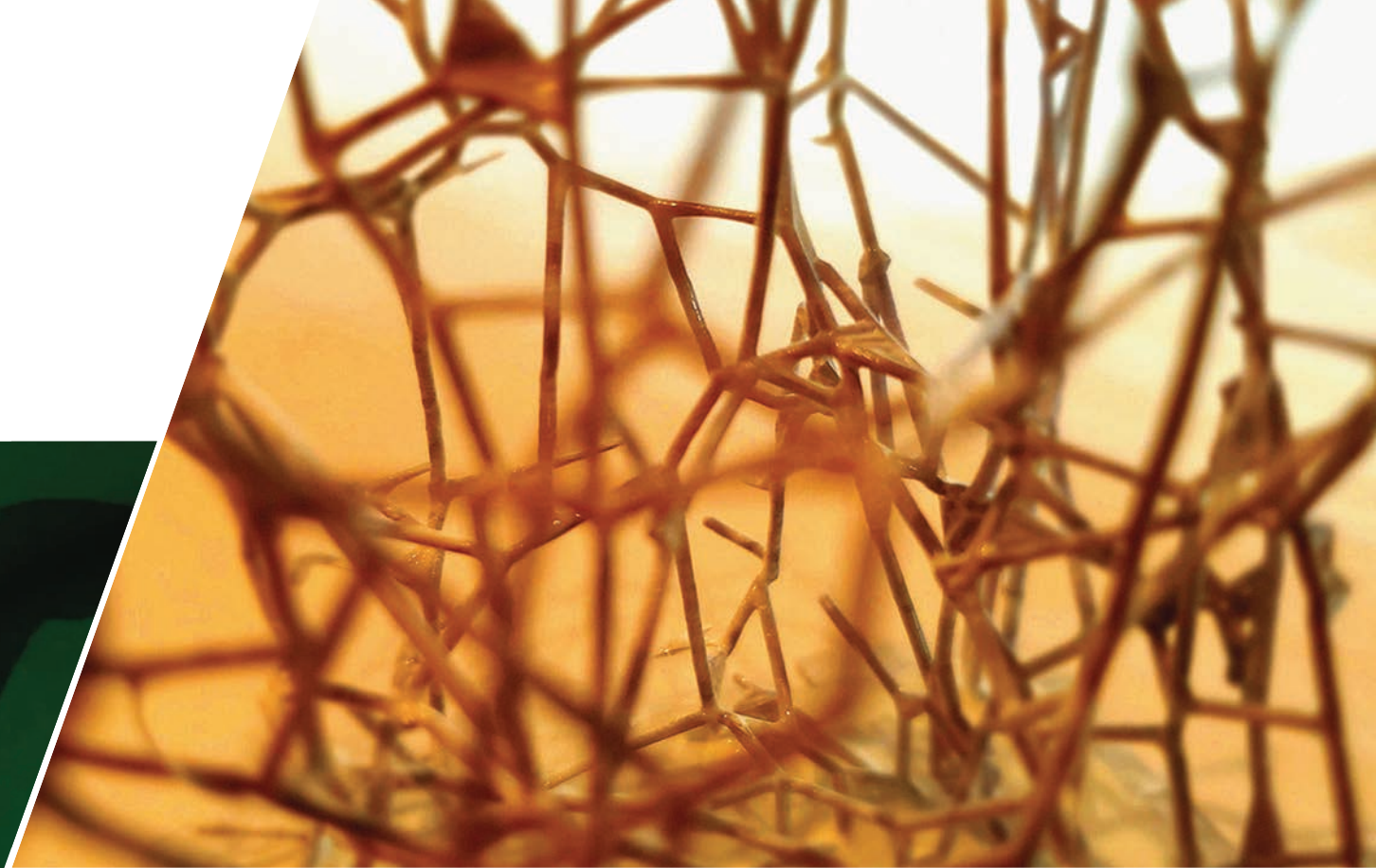
How has computation shaped the concept of intelligence? What models for the unfolding of thought does it provide? Looking at scales ranging from the human to the universe, the panel Deep Time & Intelligence examined how intelligence develops over time and in response to specific environments.

"Relieving ourselves of that overexposure of AI to intellectual sureties, we may sense a moment in which an instrument of optimization and automation becomes a medium open to reuse and comment, tinkering, and informed reflection, even a generator of surprise results."

— William Lockett

As musicologist Gary Tomlinson pointed out, meaning-making is not a fixed property but instead a flexible and evolving process, involving attention, memory, and learning, which is shaped by an organism's interactions with a changing environment. Even genes, he said, are not fixed blueprints but rather adaptive "open information systems in constant flux with the situations around them." But can machines begin to approach this kind of fluid intelligence? In his work, computer scientist Antonio Torralba builds neural networks to form sensory associations—to know the difference, for example, between the sound of a drumstick hitting a cymbal versus a drum, and whether it was a hit or a scratch, and for how long—without any human training, just as an infant learns to discriminate between different materials through senses like sight, sound, and touch.

Markus J. Buehler, Jerry McAfee (1940) Professor and Department Head, Civil and Environmental Engineering, MIT

Holly Herndon, Composer and Musician

William Lockett, Mellon Postdoctoral Fellow, CAST, MIT (Convener)

Gary Tomlinson, John Hay Whitney Professor of Music and Humanities, Yale University

Antonio Torralba, Delta Electronics Professor of Electrical Engineering and Computer Science and Head of AI+D Faculty, MIT

Unfolding Models

How does AI shape our models of the world?

How do tools in computation shape the models made by scientists, artists, and engineers? From simulations of cosmic evolution to models of the unfolding of epidemics, computer and AI-aided work sees practitioners unfolding the possibilities of digital calculation and representation. The panel Unfolding Models demonstrated how our lives are shaped by such simulations.

The cosmologist Priyamvada Natarajan discussed how she inputs telescope data into a computer simulation to understand how black holes grow in the universe. The computer model, she proposed, not only reflects knowledge but also generates it, engendering new kinds of questions and offering a common language of exchange among scientists from different subfields. Using Charles Darwin's metaphor of the entangled bank, evolutionary biologist C. Brandon Ogbunu examined how mathematical models can aid us in unfolding—disentangling— the complexities of biological and ecological systems, which, in the case of phenomena such as the contemporary global pandemic, must always be recognized as also enmeshed in sociopolitical dynamics. Artist Rosa Menkman challenged us to consider how computer models always exist within digital substrates that may glitch or stutter and, in so doing, reveal limitations—as well as unexpected possibilities— in practices of information storage and rendering.

> "Unfolding offers different, and sometimes counterintuitive and disruptive, in a good sense, ways of asking what computers do and mean."
>
> – Stefan Helmreich

Models, as convener Stefan Helmreich explained, "act as theory animated—in cosmology, biology, aesthetics—with consequences that may be all at once epistemological, political, and world bending."

Images: (left) Rosa Menkman's *Vernacular of File Formats* installed at Stedelijk Museum Amsterdam, 2009. Courtesy of the Rosa Menkman. (right, top) "Welcome to Copper World," courtesy of C. Brandon Ogbunu. Credit: Brittney Moodie. (right, bottom) The cluster of galaxies Abell 2744, over-plotted with a reconstructed map of dark matter shown in blue. Credit: ESA/ Hubble, NASA, HST Frontier Fields and J. Lotz, M. Mountain, A. Koekemoer, and the HFF Team (STScI). Overlaid reconstructed dark matter map by Mathilde Jauzac (Durham University, UK and Astrophysics and Cosmology Research Unit, South Africa) and Jean-Paul Kneib (École Polytechnique Fédérale de Lausanne, Switzerland).

Stefan Helmreich, Elting E. Morison Professor of Anthropology, MIT (Convener)

Rosa Menkman, Resolution Theorist

Priyamvada Natarajan, Professor of Astronomy and Physics and Director of the Franke Program in Science and the Humanities, Yale University

C. Brandon Ogbunu, Assistant Professor of Ecology and Evolutionary Biology, Yale University

Bias in AI
Designing new AI systems for human empowerment

While technological change is often seen as a sign of progress, the panel Bias in AI explored how entrenched prejudices are in fact built into new technologies. Sociologist Ruha Benjamin, outlining the historical connections between eugenics and statistics, discussed what she calls "the new Jim Code," in which ongoing racist practices are encoded into new technological systems, appearing everywhere from healthcare to education. Computer scientist Jon Kleinberg demonstrated, in mathematical terms, how blinding the algorithm to race or other identity categories, rather than achieving a "colorblind" neutrality, in actuality creates inequity.

"We can combine our technical and scientific approaches with the profound insights from social sciences, humanities, and the arts—ranging from feminist scholarship to digital media arts— in order to more completely understand these systems."

– D. Fox Harrell

But if artificial intelligence is used to perpetuate discrimination, can these same computational tools be used to subvert power? How might we train machines to look and act differently? With her robotic garments, artist Behnaz Farahi uses computer vision technologies to subvert the male gaze. In one "smart" cape she created, a facial-tracking algorithm provides women with information about the age and gender of those looking at them.

And yet, while it might be tempting to see artificial intelligence as a quick-fix solution to long-standing social problems, Benjamin cautions us against putting faith in a single "social justice bot" to "slay centuries of racist and sexist demons."

Images: (left) *ColorCoded* by Ruha Benjamin features a photograph of Ella Baker, American Civil Rights and Human Rights Activist, overlaid with the infographic "Occupation of Negroes and Whites In Georgia" and the patent for electronic monitoring systems and methods. Courtesy of Ruha Benjamin. (right, top) Behnaz Farahi, *Can the Subaltern Speak?*, 2020. Courtesy of Behnaz Farahi. (right, bottom) Screenshot from "Reimagining the Avatar Dream: Modeling Social Identity in Digital Media." Courtesy of D. Fox Harrell.

Ruha Benjamin, Professor of African American Studies, Princeton University

Behnaz Farahi, Assistant Professor of Design, California State University, Long Beach

D. Fox Harrell, Professor of Digital Media and Artificial Intelligence, MIT Comparative Media Studies Program and MIT Computer Science and Artificial Intelligence Laboratory (CSAIL); and Director of the MIT Center for Advanced Virtuality (Convener)

Jon Kleinberg, Tisch University Professor of Computer Science, Cornell University

Open Systems
Expanding our ideas of intelligence

The panel, Open Systems, convened by Caroline A. Jones and co-presented by the Transmedia Storytelling Initiative, questioned the very definition of intelligence itself. Could the idea of sentience encompass not just an individual human brain, but also the homeostatic intelligence of a planetary body?

"For me, 'open systems' implies opening out intelligence to these different kinds of forms that might be 'machinically' more than human, or organically multispecies, or cosmically other."

– Caroline A. Jones

In her multimedia performances, artist Jenna Sutela collaborates with neural networks and extremophile bacteria in an attempt to find a common language among species. With curator Lars Bang Larsen, Sutela recast AI as a form of "alien intelligence," a more-than-human mode of cognition as found in everything from "the poorly understood gut brain of the microbes that govern our human moods to the intelligence of other-than-human entities in the universe," said Jones.

As part of understanding these more-than-human collaborative modes, biologist Megan Frederickson discussed her research on the mutualist behavior of rhizobia bacteria inside legume roots—a counterpoint to common Darwinist ideas about the "selfish gene" and the survival of the fittest—and how her team is attempting to evolve better symbionts in the lab. Could this same kind of kinship also be formed with our technologies, starting with the minerals used to create them?

Digital media theorist, poet, and software designer Jason Edward Lewis explained how artificial intelligence, as a product of an individualist and productivity-obsessed colonial Western culture, could be transformed by Indigenous worldviews that organize the world instead as a set of interconnecting relationships. AI system engineers, he said, are "blind to important aspects of human existence, such as trust, care, and community, that are fundamental to how human intelligence actually operates."

From the intelligence of microbes to Indigenous philosophies shaping a new AI, what these artists and scientists demonstrated is how systems of world building are always more than humans and their machines.

Images: (left, top) IP AI. Sergio Garzon, *Holographic Canoe*. Courtesy of the Initiative for Indigenous Futures. (right, top) Jenna Sutela, *I Magma*, 2019. Credit: Theresa Hahr, courtesy of Moderna Museet. (left, bottom) Interior page view from *The New Model: An Inquiry*, edited by Lars Bang Larsen and published by Sternberg Press, March 2020.

Megan Frederickson, Associate Professor of Ecology & Evolutionary Biology, University of Toronto Mississauga

Caroline A. Jones, Associate Dean for Strategic Initiatives, School of Architecture + Planning and Professor of History, Theory, and Criticism of Architecture and Art, MIT (Convener)

Lars Bang Larsen, Curator and Art Historian

Jason Edward Lewis, Professor of Computation Arts, University Research Chair in Computational Media, and the Indigenous Future Imaginary, Concordia University

Jenna Sutela, Bio-Artist and CAST Visiting Artist, MIT

Wet-on-Wet / Survivance
Finding the love hormone

Virtual Exhibition: *Wet-on-Wet / Survivance*,
Guggenheim Museum and e-flux Architecture, 2021
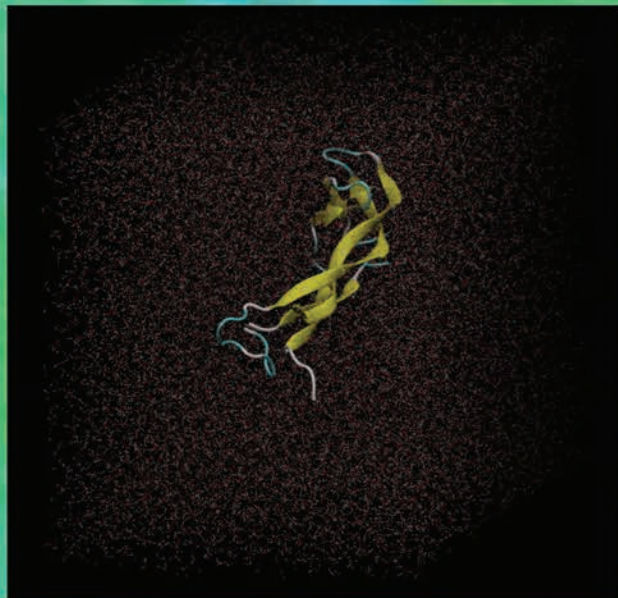
In Jenna Sutela's work, which ranges from computational poetry and experimental music to installations and performance, the artist enlists microbes and neural networks as co-creators. Bacteria and artificial intelligence are among her many collaborators in creating artworks that challenge the deeply ingrained idea that humans exist apart from the teeming, vibrating world that contains us.

"I want to explore this notion of expanded authorship through bringing in beyond-human life forms."

– Jenna Sutela

Invited to campus as a Visiting Artist by art history professor Caroline A. Jones, Sutela was inspired by the sonifications of materials scientist Markus J. Buehler, which are created by translating the vibrations of protein chains into audible sound. With the pandemic introducing a profound new global anxiety, Sutela wondered if the surge of chemicals that cause emotions such as love or bonding—what are referred to as "emotive molecules" in the project—could similarly be translated into perceptible form. By hooking an actuator up to a petri dish of water, the pair was able to see how molecular vibrations manifested as visible water waves, which a machine learning algorithm then matched to different proteins, or molecules.

The computer, with its artificial neural network, became a creative collaborator, "drawing" the invisible molecular patterns it detected on top of the images.

Could the computer detect a molecule of emotion? In short, could it see love? Buehler and postdoc Kai Guo conducted molecular dynamics modeling of the chemical structure of oxytocin, the hormone and neurotransmitter that is involved in childbirth and breast-feeding. They then translated this structure into vibrations, and taught the computer how to recognize them. "The human inspiration came in through Jenna," Buehler says.

The resulting video, *Wet-on-Wet / Survivance*, featured videos of the wet-on-wet watercolor paintings that Sutela had made as a form of lockdown meditation. This technique embraces unpredictability by letting the flow of water determine the shapes on the wet paper. The sense of calm the artist experienced was subsequently reflected by the algorithm as it traced the forms of the neurotransmitters and other emotive molecules over the moving images.
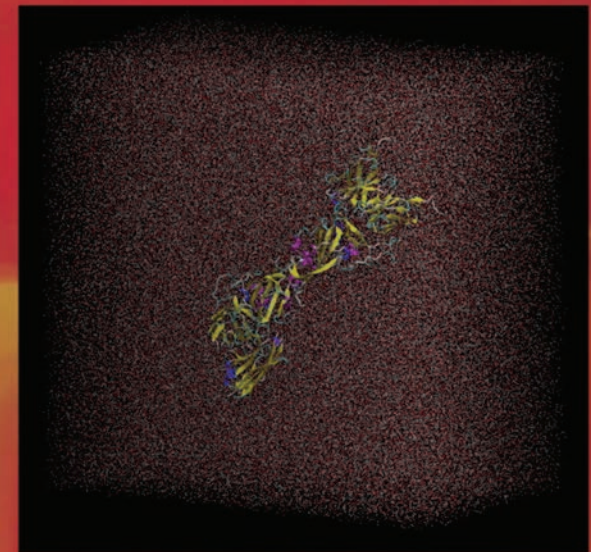
Sutela believes that the idea of water, connecting humans to one another and the wider environment, dislodges assumptions about individualism. *Wet-on-Wet / Survivance* is an empathic overture to the more-than-human world, an attempt to find a common language in the form of waves, despite the limitations of our human senses. The universe, we know, is always in motion, and each of us is vibrating matter. Sutela and Buehler's work reminds us of our oneness based on this simple physical fact. "We live on a symbiotic planet," says Sutela. "We're part and parcel."

Images: (left and right) Video still from *Wet-on-Wet / Survivance*, 2021. Credit: Jenna Sutela and Markus J. Buehler.

Markus J. Buehler, Jerry McAfee (1940) Professor, Civil and Environmental Engineering, MIT
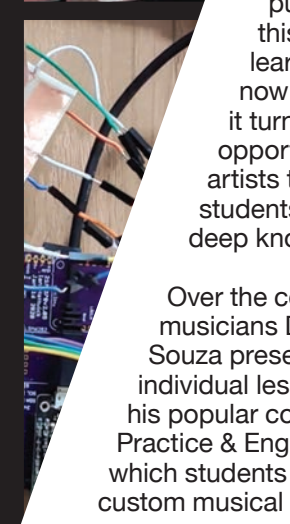
Kai Guo, Postdoctoral Associate, Laboratory for Atomistic and Molecular Mechanics, MIT

Caroline A. Jones, Associate Dean for Strategic Initiatives, School of Architecture + Planning and Professor of History, Theory, and Criticism of Architecture and Art, MIT

Jenna Sutela, Bio-Artist and CAST Visiting Artist, MIT

Virtual Mentorship

With the sudden evacuation of the MIT campus in March 2020, courses—like much of public life—quickly transitioned online. Against this radical new reality, the work of teaching and learning followed suit, with artists and educators now working with MIT students remotely. As it turned out, the digital format presented new opportunities for teaching and learning, allowing artists to develop lasting relationships with MIT students over time, as they shared their passion, deep knowledge, and, most of all, their humanity.

Over the course of the academic year, virtuoso musicians Don Byron, Anat Cohen, and Luciana Souza presented masterclasses, lectures, and individual lessons, while lecturer Ian Hattwick reprised his popular course, Instrument Design as Artistic Practice & Engineered Expression Performance, in which students had the opportunity to design their own custom musical instruments.

At the same time, Virtual Visiting Artists were equally enriched by their experiences mentoring MIT students through the arts. "We have artists who understand that it's not a gig; it's not about just showing up and doing your thing. They want to be invested in what they're doing not just because it's MIT, but because they feel from the students a sense of urgency, a sense of excitement," says Frederick Harris, Jr., Director of the MIT Wind Ensemble and the MIT Festival Jazz Ensemble and a Lecturer in Music in Music and Theater Arts. During a time of physical isolation, these online residencies offered a crucial sense of human connection through the arts.

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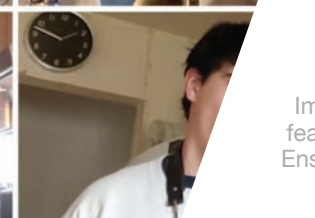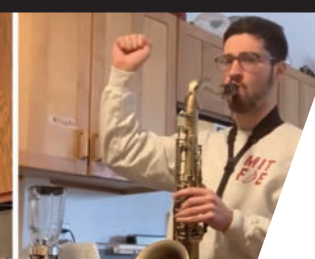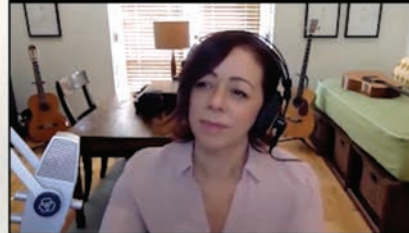
Images: Assortment of screenshots from virtual classes and workshops, featuring Don Byron, Anat Cohen, and Luciana Souza with the MIT Wind Ensemble, MIT Festival Jazz Ensemble, and MIT Vocal Jazz Ensemble.

Virtual Visiting Artists

Sounding out new methods for mentorship

During periods of political crisis and social division, musicians have always found ways to connect communities through sound. Initiated as a pragmatic response to the pandemic, the Virtual Visiting Artists program has become an online laboratory for new approaches to pedagogy and performance. The three distinguished artists—Don Byron, Anat Cohen, and Luciana Souza—have infused the MIT curriculum with imagination and energy, introducing influences from diverse musical cultures and using the virtual space to sound out possibilities for improvisation, group learning, and auditory experiments.

Brazilian-born vocalist Luciana Souza is a major figure in the worlds of vocal jazz and Latin music, performing as a soloist with the world's leading orchestras, and recording with artists including Paul Simon, Herbie Hancock, and James Taylor. In 2017, Souza collaborated with the Argentinian pianist and composer Guillermo Klein to create a series of innovative new compositions and

arrangements for the MIT Wind Ensemble, MIT Festival Jazz Ensemble, and MIT Vocal Jazz Ensemble. As Virtual Visiting Artist, she returned to lead a yearlong exploration of the cross-cultural exchange that fuels Brazilian music. In addition to presenting classes on Brazilian rhythms, efficient vocal practice, and wordless singing, Souza has created a new composition with the MIT Vocal Jazz Ensemble, which will premiere in the coming year. Central to her residency was a six-part seminar exploring the musical legacy of the composer, pianist, and songwriter, Antônio Carlos Jobim.

"We had to figure out a whole other way of how to talk about music, how to play music, how to hear each other with delays, how to figure out how to communicate and remember the essence of music and how therapeutic it is to our soul."

– Anat Cohen

The legendary African American clarinetist and composer Don Byron has long been associated with MIT. In 2007–08, Byron was appointed Martin Luther King Jr. Visiting Professor in Music and Theater Arts, and he has regularly taken part in workshops and collaborative performances with MIT ensemble groups. In 2013, the MIT Wind Ensemble premiered Byron's *Concerto for Clarinet and Wind Ensemble*, and in 2018 he participated in The Great Clarinet Summit, where he was joined by clarinet soloist and fellow Virtual Visiting Artist, Anat Cohen. In 2020, the MIT Symphony Orchestra performed a digitally screened world premiere of Don Byron's *Three Pieces from the Saul Bass Project*, and over the last year Byron has presented a series of guest lectures, masterclasses, small group sessions, and private lessons. As Virtual Visiting Artist, Byron has vividly shared his wide-ranging influences, including klezmer, gospel, and film composition, while examining the ways that racial discrimination has shaped the history of music. Byron also hosted a podcast featuring pioneering performers and composers working across a range of musical genres.

Anat Cohen is an Israeli clarinetist renowned for her expressive virtuosity and charismatic stage presence. Cohen performed in the Great Clarinet Summit in 2018, and her role as Virtual Visiting Artist has been a chance to investigate the deeply personal process of music-making. Referencing a broad range of influences from jazz, classical, and world music traditions, Cohen has presented online masterclasses, lectures, and individual lessons that explore the technical and emotional aspects of developing a unique musical style and gestural language. One of the highlights of Cohen's appointment was a special masterclass presented alongside her two siblings, the trumpeter Avishai Cohen and the soprano saxophonist Yuval Cohen. The siblings have been performing together since childhood, and they shared their insights about improvisation, listening, and the importance of forming trust in rehearsals and performances.

The generous presence of the Virtual Visiting Artists has granted MIT students and faculty unparalleled access to the ideas and practice of three of the world's greatest musicians. Characterized by collaborative resourcefulness and informal sociability, the virtual classes and individual lessons achieved a new intimacy of exchange—providing food for thought as we return to in-person learning and consider new hybrid models. The pandemic has proved that the possibilities for mentorship are multiple, adaptive, and ever-evolving.

Image: Luciana Souza plays a recording of Antônio Carlos Jobim during the virtual six-part seminar *The Musical Worlds of Antônio Carlos Jobim.*

Don Byron, Composer/Clarinetist, 2020–21 Virtual Visiting Artist, MIT

Anat Cohen, Composer/Clarinetist, 2020–21 Virtual Visiting Artist, MIT

Genevieve Dempsey, Lecturer in World Music, Music and Theater Arts, MIT

Frederick Harris, Jr., Director of the MIT Wind Ensemble and the MIT Festival Jazz Ensemble and a Lecturer in Music, Music and Theater Arts, MIT

Laura Grill Jaye, Director of the MIT Vocal Jazz Ensemble, MIT

MIT Festival Jazz Ensemble

MIT Wind Ensemble

Luciana Souza, Musician, 2020–21 Virtual Visiting Artist, MIT

Leslie A. Tilley, Associate Professor of World Music, Music and Theater Arts, MIT

Evan Ziporyn, Kenan Sahin (1963) Distinguished Professor of Music and Theater Arts and Faculty Director of tCAST, MIT

Digital Instrument Design |
Engineered Expression: Digital Instruments in Performance
A hands-on approach to sonic world-building

Course: Digital Instrument Design, Course 21M.370, Spring 2021

Concert: *Engineered Expression: Digital Instruments in Performance*, May 7, 2021

Music technology is a flourishing area of study at MIT, training students in the multimodal thinking skills that prove crucial for complex problem solving and creative envisioning. Ian Hattwick's course Digital Instrument Design is one of the most popular in the field, offering students hands-on experience in creating software systems, hardware interfaces, and interactive artworks.

Hattwick is a performer as much as a technologist, and his own experiments in instrument design include developing the Guitamaton: a computer-controlled version of an acoustic guitar, inspired by the rhythmic modality of African music. The course offers a comparable hybridity of cultural influences, contextualizing contemporary digital instruments with references ranging from the sacred mbira "thumb piano" of East Africa to China's seven-stringed guqin, associated with the Confucian philosophical tradition.

Taking inspiration from ancient and contemporary practice, students are invited to explore the ways that instrument design might facilitate social and embodied interaction, situating the design of technological systems in relation to the body and the rhythm of the breath. This emphasis on live physicality has acquired particular resonance during the pandemic, and virtual classes were developed to include new elements of interactivity. Visiting Artists, including Marije Baalman, Johan Eriksson, Christopher Janney, and Autumn Rogers, were invited to take part in classes, and the spring 2021 semester concluded with a new virtual concert and workshop organized by Hattwick, *Engineered Expression: Digital Instruments in Performance*.

Featuring instruments ranging from light-emitting spinning tops to gloves fitted with gyroscopes and magnetometers, the concert revealed the essential interdependence of performance styles and digital operating systems. The students' own custom instruments were equally inventive, with projects including a spiked cyberpunk prosthetic for drone compositions and a synthesizer operated by moving wine glasses across a tabletop. Combining wit, creativity, and technical virtuosity, the work produced during the course demonstrates a uniquely humanistic approach to design—a mindset that is all the more necessary as digital systems increasingly inform daily life.

> "What we [humans] can imagine is only the beginning … we can make sounds you can't imagine. We can discover new sounds and new forms of music-making."
>
> – Ian Hattwick

Marije Baalman, Artist, Researcher/Developer

Myriam Bleau, Composer, Digital Artist, and Performer

Johan Eriksson, Composer

Christopher Janney, Sound Artist

Ian Hattwick, Lecturer, Music Technology, Music and Theater Arts, MIT

Autumn Rogers (80KV), Noise/Industrial Musician, Performance Artist, and Mixed Media Sculptor

Tristan Shone (Author & Punisher), Musician and Sculptor

Images: (left) Serena Do presents "Cap Sensing Instrument," during virtual class demonstrations. (right) Myriam Bleau's *Natures Mortes*, 2018.

Acknowledgments

CAST Executive Committee

Markus J. Buehler
Jerry McAfee (1940) Professor in Engineering and
Head, Department of Civil and Environmental Engineering

Vladimir Bulović
Founding Director of MIT.nano, Professor of Electrical Engineering and Computer
Science, and Fariborz Maseeh (1990) Chair in Emerging Technology

Peter H. Fisher
Department Head and Professor of Physics, Department of Physics

Stefan Helmreich
Elting E. Morison Professor of Anthropology

Caroline A. Jones
Associate Dean for Strategic Initiatives, School of Architecture + Planning and Professor
of Art History, History, Theory, Criticism Section, Department of Architecture and Art

Philip S. Khoury
Associate Provost and Ford International Professor of History

Leila W. Kinney
Executive Director of Arts Initiatives and the Center for Art, Science & Technology

Melissa Nobles
Kenan Sahin Dean of the MIT School of Humanities, Arts, and
Social Sciences and Professor of Political Science

Hashim Sarkis
Dean of the School of Architecture + Planning and Professor of
Architecture and Urban Planning

Evan Ziporyn
Kenan Sahin (1963) Distinguished Professor, Music and Theater Arts and
Faculty Director of the Center for Art, Science & Technology

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Program Support and Staff
Harry Bachrach, Lydia Brosnahan, Stacy DeBartolo, Heidi Erickson,
Katherine Higgins, Danna Solomon, Leah Talatinian, and Susan Wilson

CAST Selection Committee

Allan Adams
Research Scientist, Comparative Media Studies/Writing and Principal Investigator,
Future Ocean Lab

Judith Barry
Director and Professor, Program in Art, Culture, and Technology

Ian Condry
Professor of Global Studies and Languages with joint appointments in
Comparative Media Studies/Writing and Anthropology, MIT

Greg DeFrancis
Director of Engagement and Cambridge Science Festival, MIT Museum

Timothy Fessenden
Postdoctoral Fellow, Koch Institute for Integrative Cancer Research

Adam Haar
Research Assistant, Fluid Interfaces, Media Lab

Stefan Helmreich
Elting E. Morison Professor of Anthropology

Henriette Huldisch
Director of Exhibitions and Curator, MIT List Visual Arts Center

Leila W. Kinney
Executive Director of Arts Initiatives and the Center for Art, Science & Technology

William Lockett
Postdoctoral Fellow, Center for Art, Science & Technology

Ana Miljački
Associate Professor of Architecture

Alexandra Rieger
Research Assistant, Opera of the Future, Media Lab

Jay Scheib
Class of 1949 Professor of Music and Theater Arts

Evan Ziporyn
Kenan Sahin (1963) Distinguished Professor, Music and Theater Arts and
Faculty Director of the Center for Art, Science & Technology