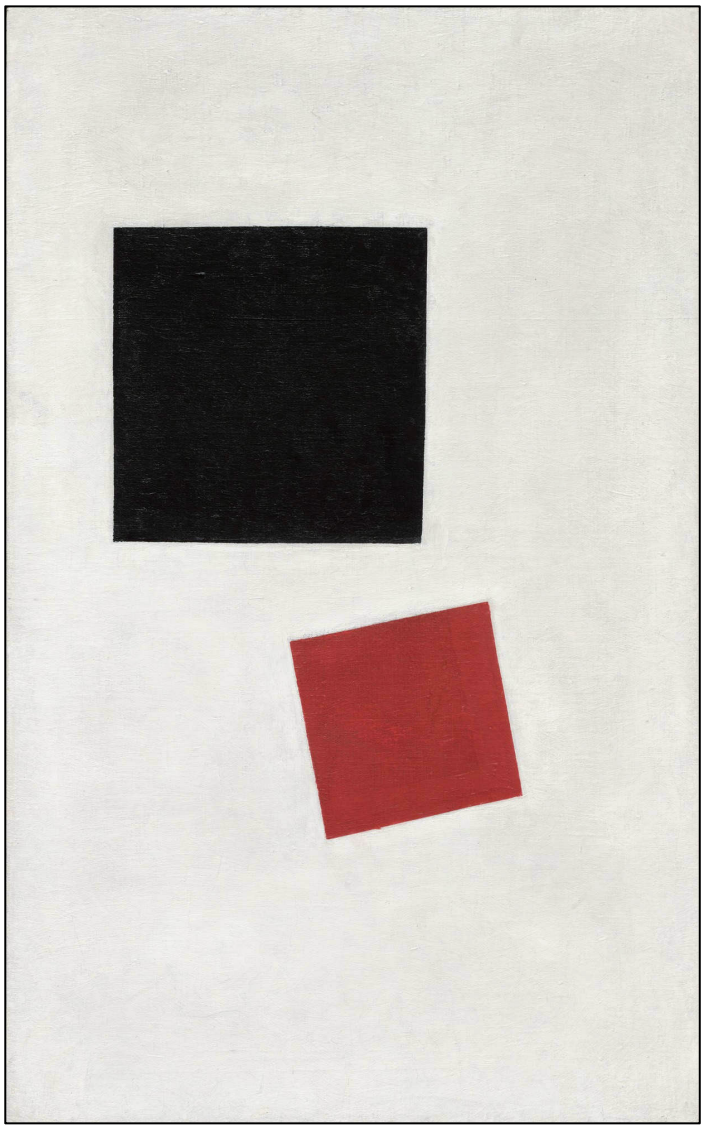
Art & Science: Perspectives and Prospects

A workshop hosted by Boston College, 8-10 April, 2026

Supported by the National Science Foundation
and the Department of Physics



Kazimir Malevich *Black Square and Red Square* (1915)

WELCOME

This workshop follows three earlier NSF-funded meetings in a series aiming to build bridges between the art and science communities, and to foster cross-disciplinary exchange of ideas. The previous three workshop were on *Perceiving Art: Physics and Research Challenges* (Institut Henri Poincaré, Paris, 15-18 October, 2023); *Size, Scale, and Scaling in Art* (Isaac Newton Institute, Cambridge, UK, 2-5 April, 2024); and *Movement and Time in Art* (Santa Fe Institute, Santa Fe, NM, 17-20 November, 2024).

After these three "topical" workshops, whereby all participants gave a presentation addressing the titular theme from the perspective of their own discipline and research, the present meeting, the last one of the series, is envisioned as more open-ended and without a single, overarching theme. There are two, related, broad goals. The first is to assess the contributions already made in stimulating research and fostering an interdisciplinary dialogue at the science-art interface. The second is to look ahead and consider in some detail how the experiences and ferment generated to date can be preserved and extended.

To optimize opportunities for a constructive exchange of ideas, which can then be translated into concrete plans, the workshop brings together a broad range of experts in mathematics, physics, neuro- and cognitive sciences, and also visual artists, musicians, composers, and art historians. We aimed to include some of the past participants representing various fields and research methods, and also many new colleagues.

Consistent with our goals, the format of the workshop is also more flexible than in the past, with two keynote talks in each of the six session, followed by open-ended panels, with shorter presentations by the remaining panelists.

The meeting is accompanied by a small exhibition of works by a Brazilian painter, Manoel Veiga, which will be on display at the McMullen Museum of Art at Boston College. The exhibition will run from April 8 through May 30.

We are grateful to the National Science Foundation for the generous grant supporting this workshop and to the Department of Physics for additional funding, logistical support, and for hosting the meeting

Organizers:
Beata Bajno, Jane Carter, Andrzej Herczyński, Jacek Rogala

Advising Group:
Marek Kuś, Shabnam Kadir, Jonas Mureika, Marco Buongiorno Nardelli

SCHEDULE

Tuesday, April 7

Arrivals
Informal reception 6 pm (place TBD)

Wednesday, April 8

8:30 – 8:50 breakfast
8:50 – 9:00 welcome

Session 1: Mathematics & Art

Chair Marek Kuś

9:00 – 9:40 Helena Verrill (University of Warwick)
Origami Waterbomb base corrugations and tessellations variations

9:50 – 10:30 Henry Segerman (Oklahoma State University)
Variants of the 15-puzzle and the effects of holonomy

10:40 – 11:00 coffee break

11:00 – 12:30 panel presentations and discussion

Anne-Marie Aubert (CNRS Paris), Shabnam Kadir (Univ. of Hertfordshire, moderator), Marek Kuś (Polish Academy of Sciences), Henry Segerman, Helena Verrill.

12:30 – 13:30 lunch

Session 2: Physics & Art

Chair Andrzej Herczyński

13:30 – 14:10 Ágnes Mócsy (Pratt Institute)
From Quarks to Cinematic Sparks: Art as Method in Physics

14:20 – 15:00 L. Mahadevan (Harvard Univ.)
Folds, cuts and vibrations

15:10 – 15:30 coffee break

15:30 – 16:50 panel presentations and discussion

Andrzej Herczyński (Boston College), L. Mahadevan, Ágnes Mócsy, Jonas Mureika (Loyola Marymount Univ., moderator).

Welcome Reception & Gallery Opening 17:30 – 19:30

18:00 – 18:30 Manoel Veiga
Uncharted shores: painting with fluid dynamics

Thursday, April 9

8:30 – 9:00 breakfast

Session 3: Neuroscience & Perception of Art

Chair: Gabriel. Radvansky

9:00 – 9:40 Alumit Ishai (NIH)
Beauty, Art, and the Human Brain

9:50 – 10:30 Edward Vessel (City College, CUNY)
Making meaning from art, and getting pleasure from understanding

10:40 – 11:00 coffee break

11:00 – 12:30 panel presentations and discussion

Alumit Ishai, Gabriel Radvansky (Notre DameUniv.), Jacek Rogala (Univ. of Warsaw, moderator), Edward Vessel.

12:30 – 13:30 lunch

Session 4: Creativity & Science

Chair: Manoel Veiga

13:30 – 14:10 Lynn Gamwell (School of Visual Arts, NYC)
Black Hole Aesthetics: Artistic Images of Invisible and Inescapable Objects

14:20 – 15:00 Aaron Kozbelt (Brooklyn College, CUNY)
Evolutionary-Developmental Biology as a Model for the Human Creative Process

15:10 – 15:30 coffee break

15:30 – 17:00 panel presentations and discussion

Beata Bajno (artist, moderator), Roger Beaty (PSU), Lynn Gamwell, Aaron Kozbelt, Manoel Veiga (artist, São Paulo).

Workshop Dinner 18:00 – 21:00
Mamma Maria, 3 North Square, Boston.

Friday, April 10

8:30 – 9:00 breakfast

Session 5: Visual Art & AI

Chair: Neo Chung

9:00 – 9:40 Aaron Hertzmann (Adobe Research)
Can Computers Create Art? Lessons From Art History

9:50 – 10:30 Mauro Martino (MIT)
AI Sculptures: When Algorithms Meet Bronze

10:40 – 11:00 coffee break

11:00 – 12:30 panel presentations and discussion

Neo Chung (Univ. of Warsaw), Aaron Hertzmann, Mauro Martino, Stella Yu (Michigan Univ., moderator).

12:30 – 13:30 l lunch

Informal discussion: *What next?*

Session 6: Music & AI

Chair: Marco Buongiorno Nardelli

13:30 – 14:10 Ted Moore (Johns Hopkins University)
Composing Entropy

14:20 – 15:00 Jonathan Wyner (Berklee College of Music)
Potential and Peril of Abstraction in Music

15:10 – 15:30 coffee break

15:30 – 17:00 panel presentations and discussion

Marco Buongiorno Nardelli (UNT, moderator), Ted Moore, Colin Stokes (composer, UNT), Jonathan Wyner.

17:00 – 17:20 coffee break

17:20 – 18:30 **Concert**

Marco Buongiorno Nardelli, *flute & electronics*
Colin Stokes, *cello & electronics*

TITLES & ABSTRACTS

Anne-Marie Aubert: Aperiodic tilings: from art to noncommutative geometry.

Tilings were originally defined as coverings of the euclidean plane by compact tiles without overlap. Historically, they have been studied with a special emphasis on periodic tilings in which a finite domain is repeated periodically on the whole plane. In the 60s emerged the notion of aperiodic sets of tiles, i.e., those allowing to tile the plane in a nonperiodic way. An aperiodic tiling is a tiling by an aperiodic set of tiles. By assigning in a coherent way a C*–algebra to a tiling we can study the tiling using tools of noncommutative geometry. Scientific interest in aperiodic tilings is due to the complexity of their structure, and this complexity is also the source of their artistic interest.

Beata Bajno: Embracing Uncertainty

Polish painter Stanisław Fijałkowski, when asked what interests him most in the creative process, pointed to what he called the *vibration of possible meanings* — or the creation of a *boundary value*. He referred to Kandinsky, who said that when form reaches its limit, two different possibilities for its interpretation arise simultaneously. This state of being suspended at an "indistinct and mobile" boundary deeply fascinated Fijałkowski; he believed it applied equally to scientific inquiry. He also claimed that the artist creates the form which may take on meanings he could not have foreseen.

The painter Teresa Pągowska, in turn, observed: "It is good when an irrational moment manages to slip between the thinking. If it proves apt and fills a gap that cannot be resolved rationally — it enriches the value of the painting. It often turns out that what I did 'irrationally' is precisely what I had originally intended."

I would like to consider how far the observations of artists overlap with those from the world of science, and to what extent an unresolved state of mind can be regarded as an indispensable condition of the creative process.

Roger Beaty: Measuring and Enhancing Human Creativity with AI

Artificial intelligence is transforming creativity research, opening new possibilities for measuring and enhancing human creativity. This talk explores how AI is being used to evaluate creative thinking at scale, and introduces new work on creative direction — measuring how people actively shape the co-creative process with AI.

Neo Christopher Chung: Emergent Aesthetics: Artistic Practice in the Age of AI

This talk reflects on visual AI as a new artistic medium shaped by emergence, feedback, and complex systems rather than merely a tool for image generation. Drawing from my practice as both a media artist and AI researcher, I explore how artistic experimentation can reveal the aesthetic and philosophical dimensions of machine intelligence. Through my projects, I will discuss how AI-driven artworks can expose the fragile and sometimes hazardous relationships humans develop with omnipresent computational systems. These works treat AI as part of a dynamic ecology, producing potentially unpredictable forms, infinite feedback, and new aesthetic experiences. Rather than displacing artistic practice, AI expands the space of creative inquiry, suggesting that human creativity will persist by engaging with these emergent systems and reimagining our relationship with increasingly autonomous computational agents.

Lynn Gamwell: Black Hole Aesthetics: Artistic Images of Invisible and Inescapable Objects

A black hole is a region of spacetime where gravity is so strong that nothing, not even light, can escape. Anything that crosses the event horizon disappears into a void, and thus a black hole embodies the concept of nothingness. But paradoxically, everything that has crossed the point of no return is crushed to infinite density—the densest matter in the universe. Black holes have inspired artists around the world because the black hole's paradoxical relation of nothing and everything is embedded in both Eastern philosophy and Western modern art. In Taoism and Buddhism, everything came from nothing, and abstract art is a picture of nothing, but it can express everything. Artists arrive at the idea of a black hole—invisible and inescapable—by a different path than scientists. Some artists use the destructive power of a black hole as a symbol for the devastations and anxieties of the modern world, while others invite viewers to embrace darkness as a path to transformation and wonder.

Andrzej Herczyński: Reading art with physics

Fluid dynamics and mathematics can be brought to art in order to "read" some of its consequential properties, which are not apparent otherwise. When flow phenomena are *depicted* in paintings, a stratagem rendering motion in the static medium, they can be used to glean insights into the scene. And when, by contrast, fluid flows are *deployed* to paint, as was the habit of abstract expressionists, the resulting painterly effects can reveal details of the artistic technique. Abstract art (and not only) can also be analyzed using *fractal contours*, which uncover precise scaling properties of images. For all these approaches, I will briefly describe some of the recent results, work in progress, and challenges ahead.

Aaron Hertzmann: Can Computers Create Art? Lessons From Art History

Can AI algorithms make art, and be considered artists? Within the past decade, the growth of new neural network algorithms has enabled exciting new art forms with considerable public interest. These tools raise recurring questions about their status as creators and their effect on the arts. In this talk, I will discuss how these developments parallel the development of previous artistic technologies, like oil paint, photography, and traditional computer graphics, with many useful analogies between past and current developments. I argue that art is a social phenomenon, that "AI" algorithms will not have human-level intelligence in the foreseeable future, and thus it is extremely unlikely that we will ever consider algorithms to be artists. However they, like past art technologies, will change the way we make and understand art, and have considerable societal impact.

Alumit Ishai: Beauty, Art, and the Human Brain.

National Center for Advancing Translational Sciences (NCATS) / NIH
In this talk, I argue that viewing art is not a passive process, but rather a dynamic cognitive function that engages activation in distributed cortical networks in the human brain. I review behavioral and fMRI studies demonstrating that: i) Rating facial attractiveness and aesthetic value of paintings recruits regions of the brain's reward circuitry; ii) recognizing familiar objects in abstract and indeterminate art compositions engages neural mechanisms underlying attention, mental imagery, and retrieval from memory; and iii) Training naïve participants to recognize familiar objects in Cubist painting leads to significant, measurable behavioral and neural changes and involves brain regions that mediate contextual associations. Collectively, these empirical findings support the proactive brain framework, which proposes that our brain constantly generates predictions and assigns value to perceptual input, transforming ambiguous and complex stimuli into meaningful and affective representations. The dialogue between science and art is therefore not only central to understanding the human condition but is also well positioned to inform the development of prevention and intervention programs designed to enhance health and well-being.

Shabnam Kadir: Topological insights into abstract art: composition and perception

Applied topology can offer new insight into the perceptual and cognitive processes underlying human responses to visual art, as well as artistic composition itself. Human vision relies on feature-specific neural codes for edges, contrast, and colour, and higher-order visual areas rapidly privilege holistic shape structure—an essential mechanism in perceptual integration and aesthetic judgement. Using persistent homology on cubical complexes, we analysed abstract artworks created by a human artist alongside AI-generated pseudo-art. Eye-tracking, EEG, and subjective evaluation data were collected from art students viewing these works.

Our approach provided highly effective methods of disambiguation between human vs. AI-generated art, as well as easily computable, information-dense methods that quantify the characteristics of abstract art. Intriguingly, we found that the extent to which human-produced abstract art violated a topological duality (Alexander duality) was significantly different from AI-generated art, and that works by a range of abstract painters consistently converged toward a characteristic violation level of around 0.4 (a dimensionless value derived from topological invariants), suggesting the existence of an intuitively adopted, topology-based principle of compositional balance analogous to a “golden rule.”

Aaron Kozbelt: Evolutionary-Developmental Biology as a Model for the Human Creative Process

Extant psychological models of the creative process have important limitations: they are overly abstract, lack a useful sense of structure, do not predictively link up with other levels of analysis, and prioritize the ‘lightbulb’ generation of novel ideas at the expense of developing basic ideas. An alternative view, which overcomes such limitations, is to consider human creativity as an offshoot of the processes of biological evolution. Like genes in biology, ideas must ‘get along’ to produce a coherent creative whole – as in a great artwork. No one idea, however powerful, will suffice to carry a complex creative work to completion. High-level creative productivity therefore involves far more than generating new ideas; it requires the dynamic organization of creative behaviors and evaluative processes – aspects of creativity that are usually neglected in mainstream research. In particular, I will show how principles from evolutionary-developmental biology that involve the relative timing of domain-specific actions and mechanisms in the course of elaborating ideas offer an account of creativity – specifically in the domain of visual art – that overcomes the significant limitations of other process models. In general, the principles undergirding the evolution of adaptive complexity in nature can be readily adapted to better understand and characterize the human creative process.

Marek Kuś: How else can we use these wonderful mathematical gadgets to analyze pieces of art?

The mathematical image analysis methods we employ open up new avenues of research. I will outline possible applications of topological data analysis to: (a) the analysis of specific artists’ styles and stylistic changes over time; (b) the comparison of originals with copies, pastiches and forgeries; (c) an attempt at a mathematical description of compositional elements in works of art, which have been highlighted by leading theorists (Arnheim, Gombrich and others). I also intend to touch upon certain general issues regarding the applicability of these methods, and above all to present a realistic view of their usefulness and limitations.

L Mahadevan: Folds, cuts and vibrations

I will explore (the mathematical physics of) how shape and sound emerge from two humble artistic media: sheets of paper and sheets of metal. Through origami, kirigami, and related practices, I will ask how a flat sheet can be folded or cut into expressive forms; through instruments such as steelpan drums and musical saws, I will ask how curved sheets give rise to rich, resonant tones. Along the way, I will reflect on how artistic practice so often moves ahead of formal explanation, guided by intuition and craft, with its deeper logic becoming clear only in hindsight

Mauro Martino: AI Sculptures: When Algorithms Meet Bronze

The creative process behind neural network-generated sculptures, exploring the dialogue between artificial intelligence and physical materiality.

Ágnes Mócsy: From Quarks to Cinematic Sparks: Art as Method in Physics

Scientific discovery is most often communicated through equations, data, and formal publication, yet the practice of science itself unfolds through curiosity, uncertainty, imagination, and narrative. In this talk I explore how artistic practice, particularly cinema, can function not merely as communication, but as a methodological extension of scientific inquiry. Drawing on my documentary film Rare Connections, created at the Facility for Rare Isotope Beams, as well as interdisciplinary work in the classroom, I discuss how storytelling, visual language, and sensory experience can reveal dimensions of scientific practice that remain largely invisible within traditional forms of scholarship. I argue that artistic approaches open new possibilities for interdisciplinary collaboration and for a richer epistemology of science, one that recognizes knowledge as not only produced, but also lived, interpreted, and experienced.

Ted Moore: Composing Entropy

This talk explores entropy as both a creative pursuit and an aesthetic challenge in contemporary music and media art. Examples from my artistic practice demonstrate how I use computational thinking and combinatorics to create high-entropy experiences to push the bounds of artistic order and logic. Conversely, other examples demonstrate how machine learning can tame the entropy of real world media and data, drawing out musical phrasing, gestures, and form. The second part of my talk introduces MMMAudio: a new open-source creative coding environment for music and sound co-developed with my colleague Sam Pluta. A primary goal of MMMAudio is to build a bridge between our creative coding, artistic community and the machine learning and scientific world of Python. In doing so, MMMAudio broadens the creative potential of artist-coders, opening new pathways between musical creativity and data-driven practice.

Jonas Mureika: Visual Multifractals

It has been almost 30 years since the pioneering work of Taylor et al. revealed the fractal nature of Jackson Pollock's art. This spurred a variety of different statistical analysis of such paintings, including identifying multifractal structure, lacunarity, and fractal contours, to name a few. Most of these focus on the physical distribution of paint on the canvas, but an open question is whether the pattern on the canvas is actually the pattern we see. This talk will address *visual multifractals* -- patterns created by our visual cortex and processing centers — suggesting that appreciation of art has both a physical and physiological origin. The use of the multifractal spectrum to reconstruct images will also be discussed, as a potential future tool for undestanding the artistic and physical painting process.

Marco Buongiorno Nardelli: "Il Sogno di Arianna", towards a LoFi AI musical aesthetics.

"Il Sogno di Arianna (Ariadne's Dream)" is a suite for cello, flute and electronics that reimagines Bach's Suite in D minor BWV 1009 through AI-assisted composition. The musical material was generated using VEGA, a neural network model trained on Bach's cello suites, whose latent space serves as a modern labyrinth navigated by the invisible thread of the original work. Rather than seeking high-fidelity imitation, the piece embraces a LoFi AI aesthetics that values the imperfections and unexpected possibilities arising from human-machine collaboration.

This work is representative of the research being developed in the Emerging Music Intelligence Incubator (EMI^2) at the University of North Texas. EMI^2 is a program at the forefront of interdisciplinary innovation, merging the creative power of music with the computational intelligence of AI. The Incubator serves as a catalyst for pioneering research, advanced pedagogy, and artistic experimentation, fostering a unique ecosystem where science, technology, and creativity converge. By leveraging UNT's existing expertise, computational infrastructure, and strategic commitment to artificial intelligence, EMI^2 prepares the next generation of artists and scholars to lead in an era where AI-driven methodologies reshape the landscape of artistic creation and scientific inquiry alike.

Gabriel Radvansky: Just-Prior Pieces and Event Context on the Experience of Art

The current study explored how the experience of a just-prior artwork in a naturalistic setting served as a context to influence the processing of the current artwork. This was done in the setting of a guided walk through an art museum. Moreover, we also assessed the impact of event boundaries (i.e., going from one gallery to another) on this influence. We assessed the degree to which the preceding artwork and event boundaries (like moving between galleries) affect ratings of liking, emotional intensity, and the evocation of involuntary autobiographical memories. Our results revealed that the just-prior artworks and the event structure had meaningful impacts on the experience of the current artwork.

Moreover, memory for the artworks a week later were influenced by the experience of the artwork at the time of viewing, with the evocation of involuntary autobiographical memories having the strongest impact on later memory.

Jacek Rogala: A Hidden Message

Can information theory help us understand art and its impact on our brains and behavior?

Henry Segerman: Variants of the 15-puzzle and the effects of holonomy

I'll discuss some variants of the classic sliding tile "15 puzzle" that involve holonomy - the phenomenon of traveling around a loop in a curved surface and coming back rotated. I'll demonstrate physical puzzle designs with positive and with negative curvature, and discuss design considerations and consequences.

Colin Stokes: The act of becoming

This presentation examines immersive audiovisual performance as a problem of system design, drawing from my dissertation, The Act of Becoming (TAOB). At its core is a question that is partly technical and partly aesthetic: how can machine learning systems, real-time signal processing, and embodied interaction be brought into the same space without collapsing the liveness of performance?

TAOB is realized as a performance environment in which sound, image, and interaction evolve together in real time. It integrates multiple machine learning approaches, including RAVE for real-time timbral transformation and VEGA, a custom VAE–GAN hybrid model, for generating morphable symbolic musical material, and MediaPipe for computer vision. These models operate alongside a larger computational framework built in TouchDesigner, where audio analysis and generative visual systems are coupled. Visual processes draw on L-systems, strange attractors, particle systems, and feedback networks, producing forms that develop through iteration rather than precomposed structure.

What matters here is not any single technology, but how these systems behave under performance conditions. Real-time constraints begin to shape the work in very direct ways. Small changes in spectral content can reorganize visual space. A shift in model output can destabilize an otherwise coherent texture. Things don’t always behave predictably, and this is an important part of the compositional field.

The presentation will outline how these systems are designed and deployed, with particular attention to cross-modal mapping between sound and image in relation to liveness It will also address the role of the performer within this environment, where interaction functions as a form of continuous negotiation with the system.

This research proposes a model in which form emerges from the interaction of interconnected technical processes under shared constraints of time and perception.

Helena Verrill: Origami Waterbomb base corrugations and tessellations variations

The waterbomb base is a starting point for many traditional origami models. Computer scientist Ron Resch explored its incorporation into single-sheet corrugations, but similar patterns have appeared in American smocking for decades. This talk explores the continuous variation of these folded structures, applying a mathematical perspective, influenced by an algebraic geometry background, to this traditional art form. I will bring along plenty of samples to pass around.

Edward A. Vessel: Making meaning from art, and getting pleasure from understanding

When we look at visual art, how does our brain get from a representation of what we are looking at to a representation of how we feel about it? A central focus in the growing field of neuroaesthetics is to understand how a perceptual experience comes to be aesthetically appealing, such as when artwork moves us or a landscape is experienced as beautiful. In addressing this and related questions, my lab adopts an “interactionist” perspective that seeks to understand not just the stimulus being perceived, but also how a specific stimulus interacts with a specific viewer. Our work has shown that the process of constructing meaning is critical to aesthetic appeal; this process depends on how an artwork relates to the personal experience and internal models of the viewer. Using computational modeling alongside behavioral and brain imaging experiments, we are currently testing a learning theory of aesthetics. This theory suggests that aesthetic value is a form of “pleasure from understanding,” an affective learning signal that is fundamentally personal and guides people to explore information that is on the “edge” of what they know.

Jonathan Wyner: Potential and Peril of Abstraction in Music

Applying datasets to applications for musical composition, generation and performance unlocks immense potential in creative work. A tension exists between the potential and the frustration when the nature of the abstraction of features in music leads to a loss of context and other distortions in the music itself. In this talk I’ll illustrate this by giving voice to the wonder and the frustrations.

Stella YU: Visual Art and AI: What New Lessons for Seeing?

For a long time, visual art has offered powerful insights into perception. Artists have often isolated and exploited perceptual principles before they were formalized scientifically: Line drawing reveals the importance of contours and edges; caricature exaggerates diagnostic features for recognition; cubism probes part structure and

multiple viewpoints; pointillism highlights multiscale integration; chiaroscuro exploits cues to shape and depth; anamorphosis exposes viewpoint dependence; and trompe-l'oeil plays with the unstable boundary between depiction and reality. In this sense, art has long served not only as cultural expression, but also as an informal laboratory for vision.

Generative AI opens a new chapter in this relationship. The more interesting question is no longer whether AI can make art, but what becomes of art when making is redistributed across artist, model, data, interface, and audience. What is the artistic act? Where does intention reside? Who owns or authors the result? How should we think about originality, co-creation, and the fundamentally social meaning of art in this new setting?

At the same time, AI's movement beyond the screen and into sculpture and other material forms points to a deeper connection between visual intelligence and embodied making. This resonates not only with art, but also with robotics and perception-action learning: Intelligence may not lie only in producing compelling images, but also in sensing, shaping, and interacting with physical structure, space, and matter.

This panel brings together perspectives from art, computation, and visual science to ask what AI is changing in visual art — and what visual art, in turn, can still teach us about perception, intelligence, and creation.

Locations of Workshop Events