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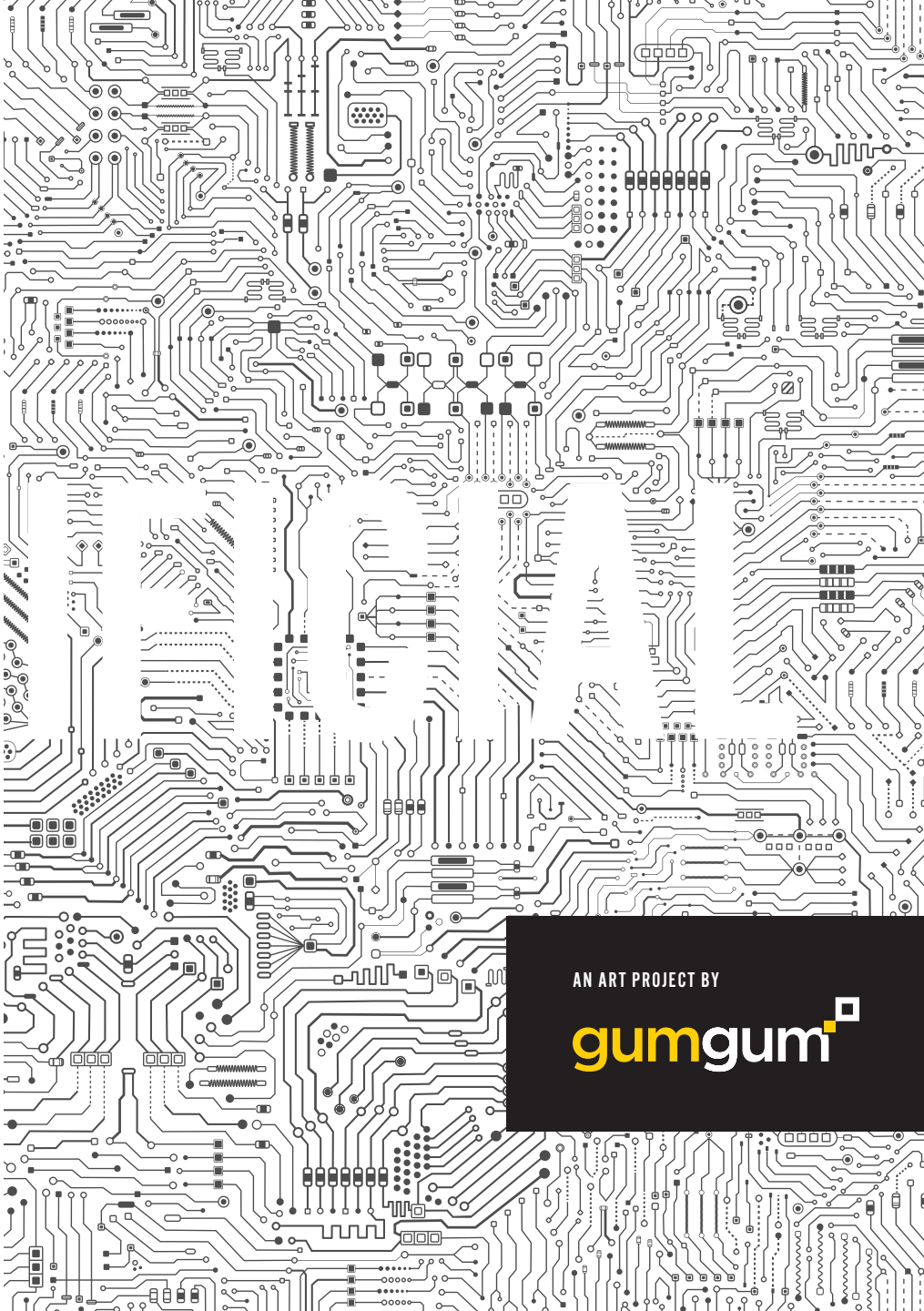

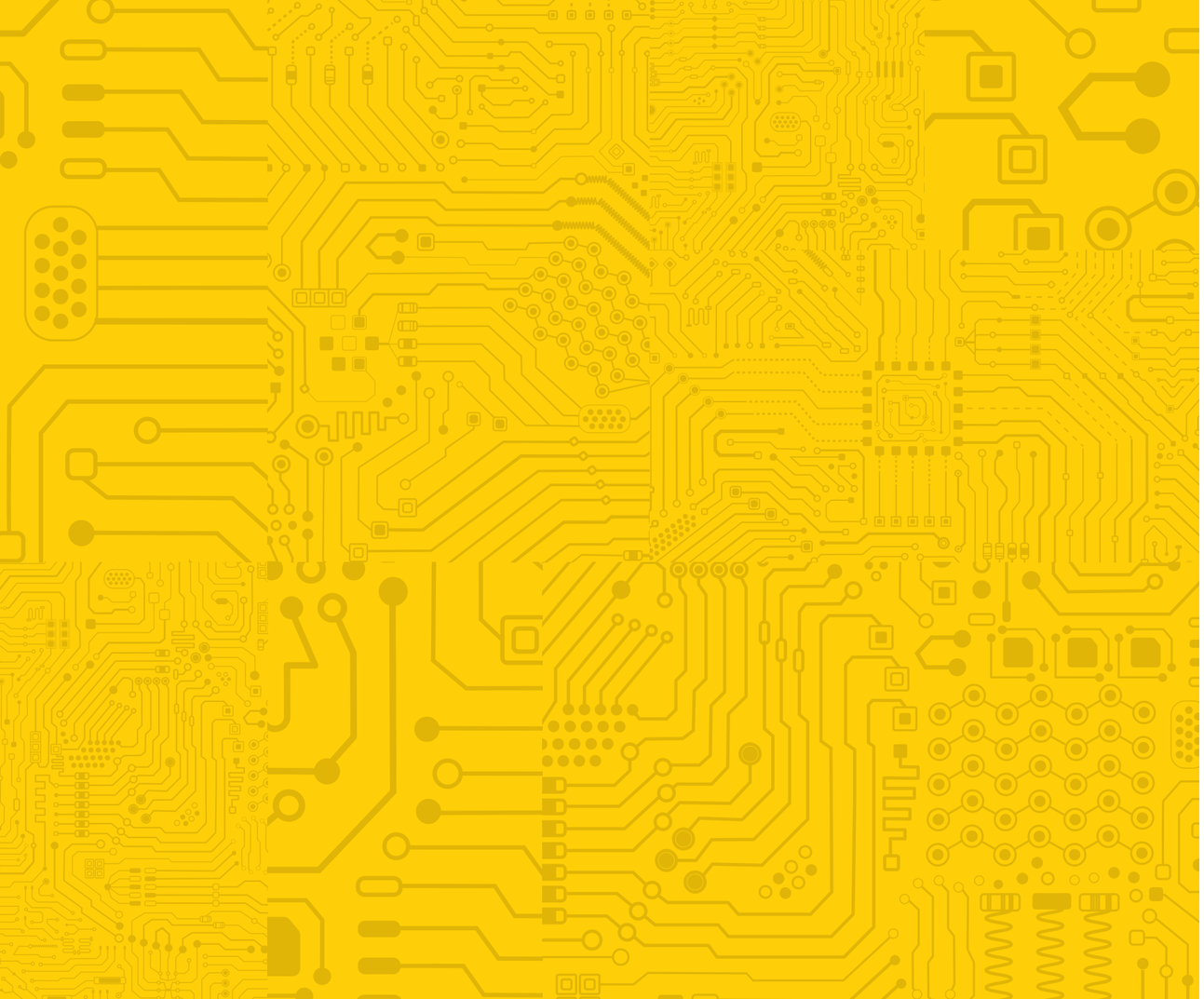

ART.IFICIAL

How artificial intelligence is paving the way for the future of creativity

AN ART PROJECT BY

gumgum

IN COLLABORATION WITH

JINDO
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RUTGERS
Art & Artificial Intelligence Laboratory

Artrendex

Publication design and layout by weather the norm BRANDING & DESIGN

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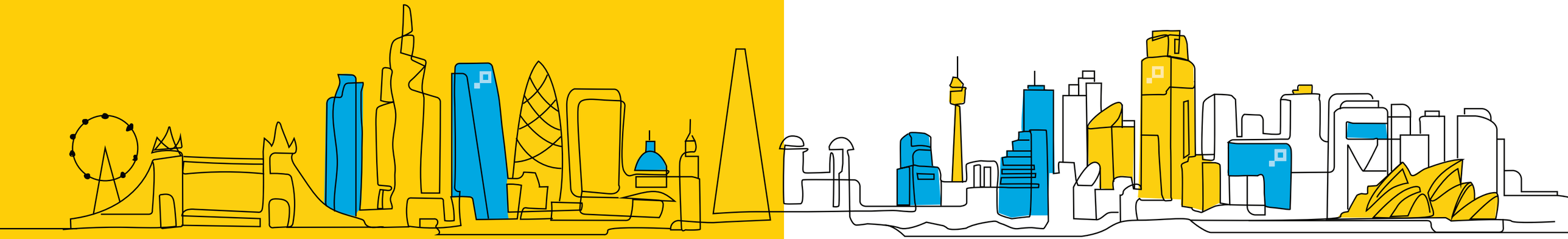
GUMGUM IS AI & ART

GumGum is an artificial intelligence company with a focus on computer vision. Our mission is to unlock the value of visual content produced daily across diverse data sets. We teach machines to see in order to solve hard problems. Our team believes in creativity of all stripes, from engineering better computer vision solutions, to designing creative that gets audience attention. Our team of engineers, marketers and designers bring art and artificial intelligence together every day.



The reviews were short, brutal and unrelenting. The critic measured hundreds of submissions, one by one, against a 600-year canon of Western art, from Ghirlandaio's "Last Supper" (1480) to Joe Goode's "Tornadoes" (1991) and beyond. And, one by one, the critic levied the same judgement: NOT ART.

On and on. Until, miraculously, the critic found something–something!–that met the complicated criteria for novelty, complexity, ambiguity.

ART. ART. ART.

The "critic" in question is just one part of an artificial intelligence system called a generative adversarial network. Trained on 62,000 paintings, the critical algorithm evaluates the work of a second "generator" algorithm programmed to create imagery. This generator algorithm begins by producing imagery at random, none of which rises to the critic's standard for art. The critic's negative feedback slowly nudges the generator to produce images that move closer and closer to the specifications set by its creators at Rutgers University's Art and Artificial Intelligence Lab.

The result, they say, is an AI that can do something long considered the sole province of human beings: create an original work of art.

ART or NOT?

There is something about artificial intelligence that inspires a low-grade panic in most people. On the one hand, AI represents an existential threat to human supremacy. Last year, Google's AlphaGo beat the world's best human player of Go, a notoriously complex strategy game with 300 times more possible plays than chess. On the other, AI represents a very practical threat to our economic well-being, eliminating jobs once performed by unskilled or junior workers. Already, AI has taken its place on the machine line (manufacturing robots), the customer service line (chatbots) and the design production line (facial recognition AI).

BUT PURSUITS THAT RELY ON AND EXPRESS OUR VERY HUMANITY–ART, LITERATURE, MUSIC– AND THE INDUSTRIES THAT HARNESS THAT CREATIVITY WERE SUPPOSED TO BE SAFE. ARTIFICIAL INTELLIGENCE THAT WRITE IRISH FOLK MUSIC, HARRY POTTER FAN FICTION AND EDIT SCIENCE FICTION MOVIES ALL APPEAR TO BE CREEPING INTO THIS MOST SACRED REALM.

"The machine developed an aesthetic sense," Professor Ahmed Elgammal, a computer scientist and the project lead, told Artsy Magazine. "It learned how to paint."

You'll get no argument there. The results were so impressive they passed a Turing Test, a test that measures how well artificial intelligence performs by comparing it to human work. In Rutgers' case, subjects couldn't tell the difference between the computer generated art and the work of Abstract Expressionists–prompting the magazine to call the work "the biggest artistic achievement" of 2017.

But can what an AI creates be called art? Art is more than a product, more than production. It requires inspiration, motivation and creativity. As Nobel Prize-winning scientist Edward O. Wilson writes in his book "The Origin of Creativity," "What then is creativity? It is the innate quest for originality. The driving force is humanity's instinctive love of novelty... the aesthetic surprise of unanticipated facts and theories, the pleasures of new faces, the thrill of new worlds."

And that's the wrench in the works of AI-created "art." If art is a process by which human beings express some idea or emotion, filter it through personal experience and set it against a broader cultural context, then what AI generates at the behest of computer scientists is NOT ART.

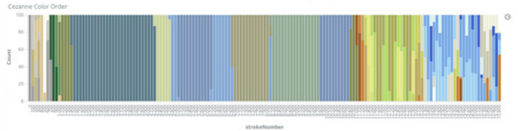
"At its root, art is one person communicating with another," said Pindar Van Arman, a classically trained artist who has been coding art robots for 15 years. "I don't think that a machine will ever make art on its own until the machine is a person."

CODE & CANVAS

What may rob the Rutgers' team of any art world cred is intent. As computer scientists, their job is to push the limits of what AI can do. But a new school of visual artists are approaching AI as a new medium that blurs the line between art and science. For Van Arman and artists like him, writing code is the creative act.

His system, called Cloudpainter, employs weighted adversarial algorithms, image recognition and feedback loops. Simply put, he programs code that operates the robots–machine arms with a paint brush and palette–and installs web cams so that they can visually process what they create and compare it to source material, usually a photographic portrait.

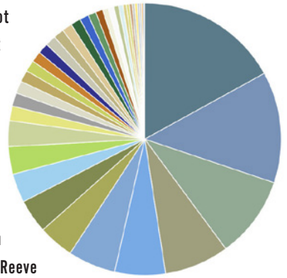
"In essence, it's looking at the canvas, creating a little, stepping back, analyzing, making some creative decisions and then painting a little more," he said. The robots are programmed to make as many aesthetic decisions as possible, from choosing a photograph to base their work on, to selecting a color palette and a style.



While the painting itself takes anywhere from 6 to 24 hours, the coding is far more involved. A simple algorithm might take a week to write, but building a complex neural network, like the one Arman is completing now, took up to a year. Often, he draws on open- source algorithms to shorten his timeline.

Along with Van Arman, there are Mario Klingmann, Jessica Brillhart and Mike Tyka, all of whom were featured in a curated show of AI works by Boston Cyberarts in January. "Every time anybody creates or invents a new medium that is potentially expressive in some way, artists are always the first ones there to try it out," said George Fifield, curator of the show and instructor at the Rhode Island School of Design.

Some of those experiments fail. "I looked at a lot of art. A bunch of it was horrible and tacky," Fifield said. "What I was looking for was thinkings that aren't immediately revealing of the process behind them. That there's a complexity that makes it somewhat mysterious and somewhat emotively complex."



Generally speaking, AI artists are not getting a warm reception from the art establishment. When Vice asked art critic Jerry Saltz to review a sampling of AI-created art, he found the selection wanting. "I don't think any artist is this boring," he said of one piece. Another he called, "a good knockoff of Shepard Fairey." Van Arman's portrait of Vice reporter Elle Reeve got the highest praise. "The robot likes post-impressionism. That's good taste."

At Rutgers, the team paired computer vision technology with an algorithm that aimed to quantify creativity by measuring the originality and influence of great Western paintings. According to their formula, which evaluated elements like space, texture, form, shape, balance and more, the most "creative" works both were novel compared to prior work and influenced the highest number of subsequent works. Among the art that scored on both counts were Edvard Munch's "The Scream," Picasso's "Ladies of Avignon" and Kasimir Malevich's "Red Square."

But the next year, when the same team programmed its own art-generating AI, it set parameters that required output to be "novel, but not too novel." In other words, original, but not so different that it put people off.

It's interesting then that Saltz saved his mildest criticism for Van Arman's portrait, which hewed closest to traditional ideas of what art should be–paint on canvas, distinct brush strokes, a pleasing color palette.

Just as Van Arman tries to imitate the creative process with his robots, he also attempts to mimic the creative mind. His code, he said, is inspired by Marvin Minsky's Society of the Mind. Minsky, co-founder of MIT's Artificial Intelligence Lab, theorized that the human mind is a collection of smaller, interactive intelligences, each of which surfaces when needed. To mimic that, Van Arman writes and weights a series of small algorithms into his adversarial system where they battle for dominance. That battle requires the machine to make decisions, which in turn powers its creativity. The result: a painting Saltz said he could mistake for the human hand. Still, Saltz was quick to conclude, "that doesn't make it better."

"I'd say AI and AI artists are basically where graffiti artists were in the 80s. It's definitely art, but it's not accepted," Van Arman said. "We need a Banksy. We need some superstar to elevate the rest of us...Right now, it's a bunch of nerds."

WHAT IS A GENERATIVE ADVERSARIAL NETWORK?

Superman and Lex Luthor. Batman and The Joker. The Generator and The Discriminator. If you're reading this sidebar, chances are you're not familiar with those last two, an adversarial pair introduced not by DC comics but by Google researcher Ian Goodfellow.

Their origins story is not terribly dark. In 2014, Goodfellow introduced the duo as opposing halves of a new unsupervised machine learning method: a generative adversarial network, or GAN. In it, "The Generator" is programmed to create new data sets. They could include paintings, prose, poetry, music and, in at least one instance, knock-knock jokes. Then, a second set of algorithms, known as "The Discriminator," evaluates and classifies those data sets.

How does The Discriminator know what fits? Its creators, most often a team of computer scientists, feed it vast sets of existing, real-world data for the GAN to emulate. Then, they weight the algorithm to skew for a particular set of attributes that, when met, allow The Discriminator to map features to categories. Essentially, The Discriminator decides if The Generator's data sets fit the bill. With each new round of data, The Discriminator pushes The Generator closer to what their creators envisioned: an approximation of the original input.

This is exactly how the Rutgers team designed its GAN, by essentially giving its discriminative algorithm a crash course in art history, then asking its generative algorithms to start painting. The discriminatory algorithm was weighted with a preference for "stylistic ambiguity" in other words, art that couldn't be easily classified as impressionist, cubist, or any other genre with well-defined visual attributes.

"What drives innovation in art is that the artist, consciously or unconsciously, pushes the limits," said Ahmed Elgammal, founder of Rutgers' Art and AI Laboratory. Here, the artist–aka The Generator–was programmed for novelty, while the critic–aka The Discriminator, measured it against a known canon to keep it from pushing too far. "You don't want to get too far away," from what the audience will recognize as art.

The result was a series of works that veered toward contemporary abstract art instead, and fooled human subjects in 2016.

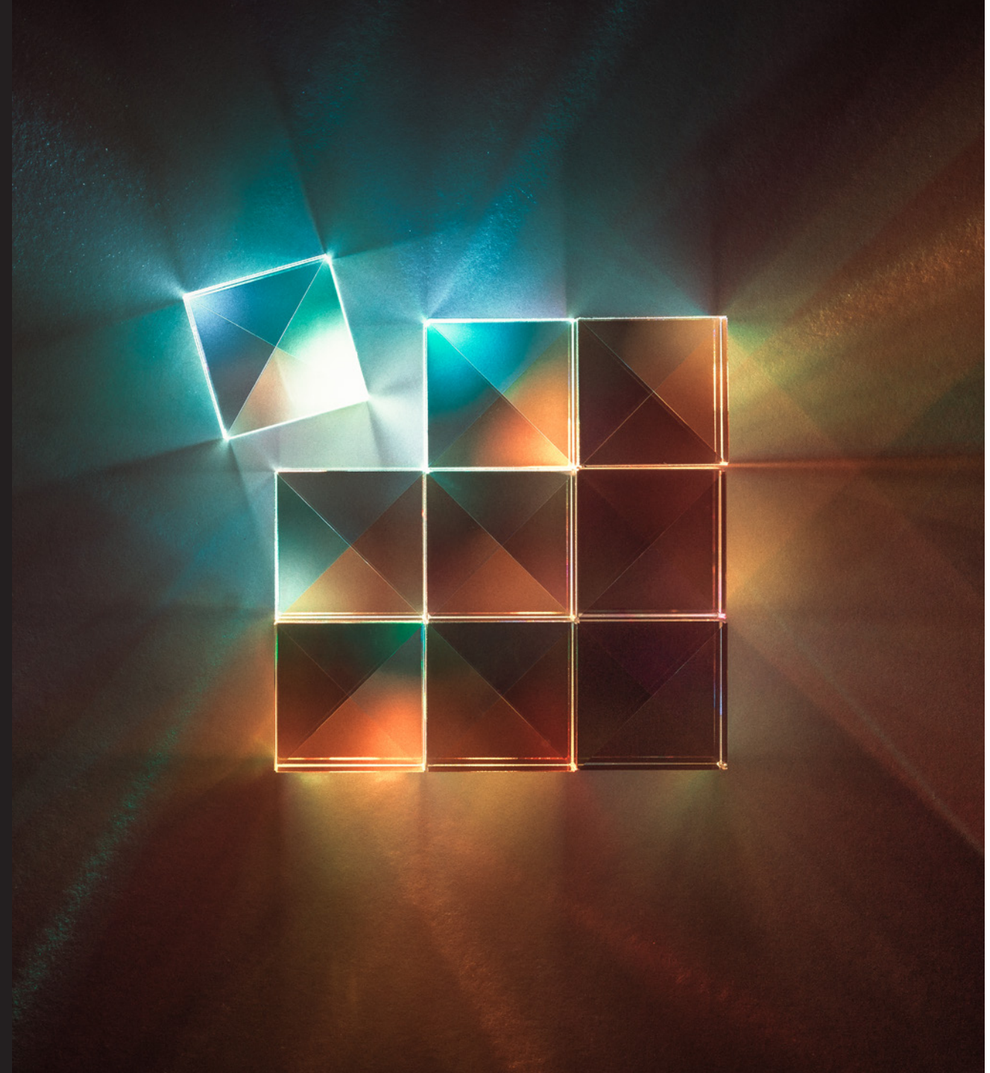
The AI Masters

Computational artists have been fighting for the art world's esteem since as early as the 1960s, long before "AI" became a household term. "The art world was very precious about what the artist does. They couldn't understand that writing code was a creative act. And so they basically said, 'well, if the computer did this, who are you?'" said George Fifield, curator of Boston Cyberarts. Consider these works by seminal AI artists as a new canon of computational art.

"STUDIES IN PERCEPTION I," 1967: This photomosaic of dancer Deborah Hay was created by computer graphics pioneer and Bell Labs programmer Ken Knowlton. It was created by scanning a photograph with a camera and converting the analog voltages to binary numbers, then assigning those numbers typographic symbols. The result is a mosaic that when seen from a distance is a female nude, but when seen close up is an array of computer graphics. Printed in The New York Times and shown at the MOMA exhibition "The Machine as Seen at the End of the Mechanical Age," this work inspired the sculptor Lillian Schwartz to join Bell Labs as its artist in residence.

"PAPILLON," 1968: By the end of her first year at Bell Labs, sculptor Lillian Schwartz had created one of the first computer-animated films. She quickly learned simple machine language–1s and 0s–and then began experimenting with how to best represent color in computer graphics by manipulating their numeric representations. "Papillion," named for butterfly wings, features expanding swaths of vibrant reds and pinks against a field of dark blues and blacks. She remained an artist in residence there through the 1970s, working with computer scientists, coders and statisticians in one of the earliest collaborations of its kind.

"CUBIC LIMIT," 1973: Considered one of the pioneers of the "generative art" movement, German-born Manfred Mohr was one of the first artists to assert that computers could indeed create art on their own. Mohr programmed the algorithms that produced his art in the FORTRAN language beginning in 1969. By the 1970s, the cube had become his muse, representing a "fixed system by which signs are generated." "Cubic Limit" is the first of that series.



Strides in AI Creativity Are Being Seen and Not Heard

If it seems that more progress is being made in the visual arts than the literary, there's good reason. The tech has already arrived. Computer vision–the analysis and processing of imagery and video by algorithms–has been around since the 1960s. But over the past six years, roughly the span of time since Rutgers founded its Art and AI Lab, the explosion of visual data available online coupled with exponential growth in computer power has driven a tremendous amount of progress in the field.

Meanwhile, language-based AI hasn't fared as well. Botnik Studios recently programmed a bot trained on all five Harry Potter novels, then asked it to create several chapters on its own. Let's just say J.K. Rowling is safe. The AI managed to craft sentences that were grammatically correct, if amateurish, but taken together the first three chapters of Harry Potter and What Looked Like a Pile of Ash made little sense.

"Leathery sheets of rain lashed at Harry's ghost as he walked across the grounds to the castle. Ron was standing there and doing a kind of frenzied tap dance. He saw Harry and immediately began to eat Hermoine's family."

Ahmed Elgammal credits some of that imbalance to ambiguity. "Ambiguity in art is something you can interpret," he said. "Ambiguity doesn't hurt art, it helps art." Not so with language, which requires a level of precision and interpretation that natural language generators just haven't cracked yet.

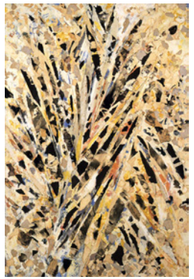
Max Fresn, Chief Creative Officer at Born AI agreed. "For the most part, we expect if you're going to read words, it's going to tell you something, it's going to take you through a beginning, a middle, and an end," he said. "Unless the computer can figure out how to generate an actual outline for a story, I don't know how we would ever actually expect them to write something from scratch."

AI vs. Human

To demonstrate just how close artificial intelligence can come to the human creative process, we devised a Turing Test of our own. We commissioned five artists–and Pindar Van Arman's Cloudpainter–to create a piece of art based on the same dataset, a collection of art by 20th century American Abstract Expressionists. Then, we asked them to document the process, showing us their preferred tools and telling us how they came to their final work. Discover the results on the following pages.

Elaine de Kooning
Bacchus #3

Elaine de Kooning's works were edged with her frustration about the marginalization of women in the art world. This piece brings together corporal figurative line work with the high-octane brush strokes typical of the Expressionist movement. We thought it would suggest an interesting sense of movement for our artists.



Lee Krasner
Burning Candles

Lee Krasner, Jackson Pollack's wife, has only begun to receive her due. This work's mosaic-like texture presented both an opportunity for our artists and a challenge for the AI. Could it integrate a dash of this reference without leaning so hard on style transfer that the work became derivative?

Michael (Corrine) West
Cythera Shrine

Created in 1978, this work communicates a modern, almost punk feel. West sometimes painted with a palette directly from the tube, then smattered her works with sand and other detritus. The splatter and bold, violent brushstrokes add a decidedly different feel than the other artists' more structured work.

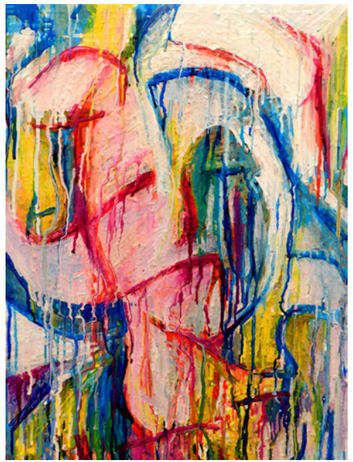
Willem de Kooning
Untitled 1

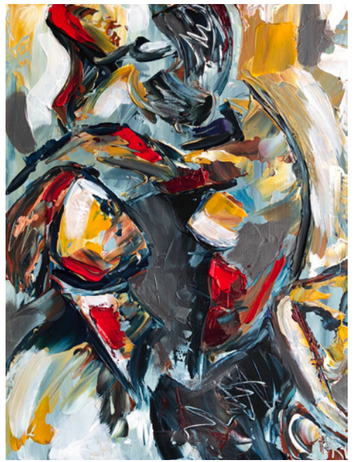
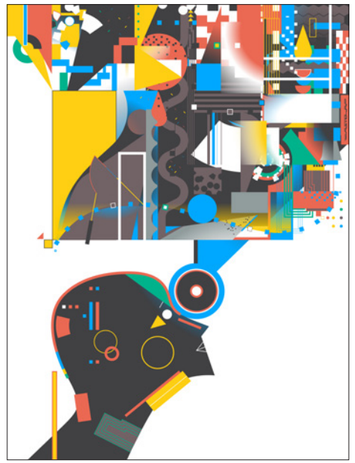
Willem de Kooning's work brought together abstract figurative painting to create colorful, kinetic works. "I paint this way because I can put more things in–drama, anger, pain, love, a figure, a horse, my ideas about space." de Kooning's own intensity and the emotionality of his work made it an interesting inspiration for AI.

Georgia O'Keefe
Grey Lines with Black, Blue and Yellow

"I wish you could see what I see out the window," O'Keefe once wrote to a friend. "The earth pink and yellow cliffs to the north–the full pale moon about to go down in an early morning lavender sky... It is a very beautiful world." O'Keefe's probing, personal portraits of the natural world made an interesting counterpoint to more abstract art.

The Gallery CAN YOU GUESS THE AI ARTWORK?




See the artists (and robots) behind the work

CLOUDPAINTER

Illustration by Eric Chow

Pindar Van Arman

WASHINGTON, DC

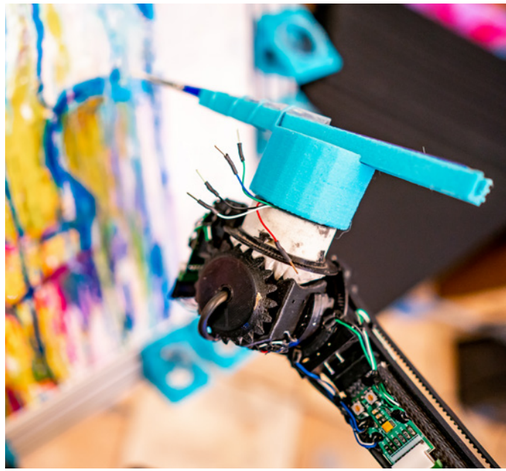
Like any artist, the Cloudpainter robot has evolved over time. In its first incarnation, the Cloudpainter was simply an automated brush following paint-by-number instructions. Now it is a complicated system informed by a variety of style transfer algorithms programmed by its artist, Pindar Van Arman, along with a rotating brush head and a feedback loop.

The work begins with a series of photographs of the portrait subject. Using facial recognition AI, the computer selects which picture it will use as its source material. Then, Van Arman programs his bot with a selection of algorithms that will work together to create an original piece of art.

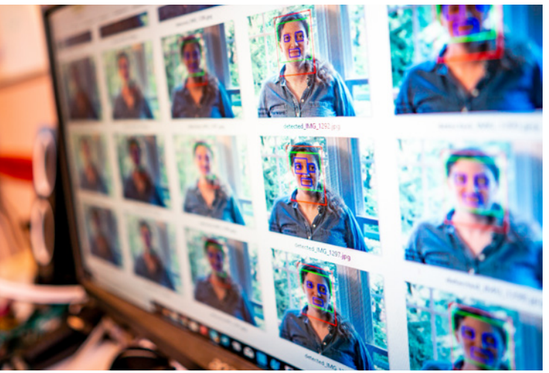
Wired directly to the bot, his computer runs the scripts that dictate how the arm should move, while a video camera records its progress and sends visual information back to the computer. That information is the key element of the feedback loop. The bot operates largely as a human artist would. It paints, pauses, and considers its progress before applying its next stroke.

The Cloudpainter uses a variety of mechanisms to paint. The robot arm pictured dips its brush into a palette of paint pots that sits beside it. Another, more complicated mechanism (not pictured) allows the brush to travel along an X/Y axis while applying colors from a rotating palette attached just below the brush head.

In all, it is a brilliant application of both mechanical engineering and artificial intelligence.



While some AI artists write increasingly sophisticated generative art algorithms, I have found that quantity is better than quality. My method is modeled on Marvin Minsky's Society of the Mind, the theory that the mind is not one single super intelligence, but rather a collection of smaller intelligences. This project was completed using a neural network of 26 different algorithms, each representing a specific intelligence.



The trace image algorithm allowed the robot to hold a picture of the source material–in this case, a photograph of our subject–in its memory. A style transfer grid algorithm ensured the robot worked within the styles of our reference paintings. A feedback loop allowed the robot to pause and consider its progress, and so on: the difference map, the paint map and others contributed to macro and micro decisions that each contributed to the 13,396 individual brush strokes on our final work.

In the final stretch, my robots attempted to paint combinations of the William de Kooning and O'Keefe works, allowing the portrait to slowly emerge. How did my robots know when they were finished? My most important algorithm is the "I've Done My Best" algorithm. With every stroke, an image is taken of the canvas and a heat map communicates the difference between the canvas and trace image. When the robot can no longer reduce the difference, it stops painting. It has done its best.

Though I wrote the algorithms, the neural network makes decisions in ways I don't always understand. At its root, though, are feedback loops. Like a human artist, the robot paints, then steps back to review its work before continuing. However, the robot's goals keep changing, ensuring no two works are the same.

Satisfied with our collaboration, I decide that the artwork is complete. Interestingly, this is the only decision that really matters for a piece of art.

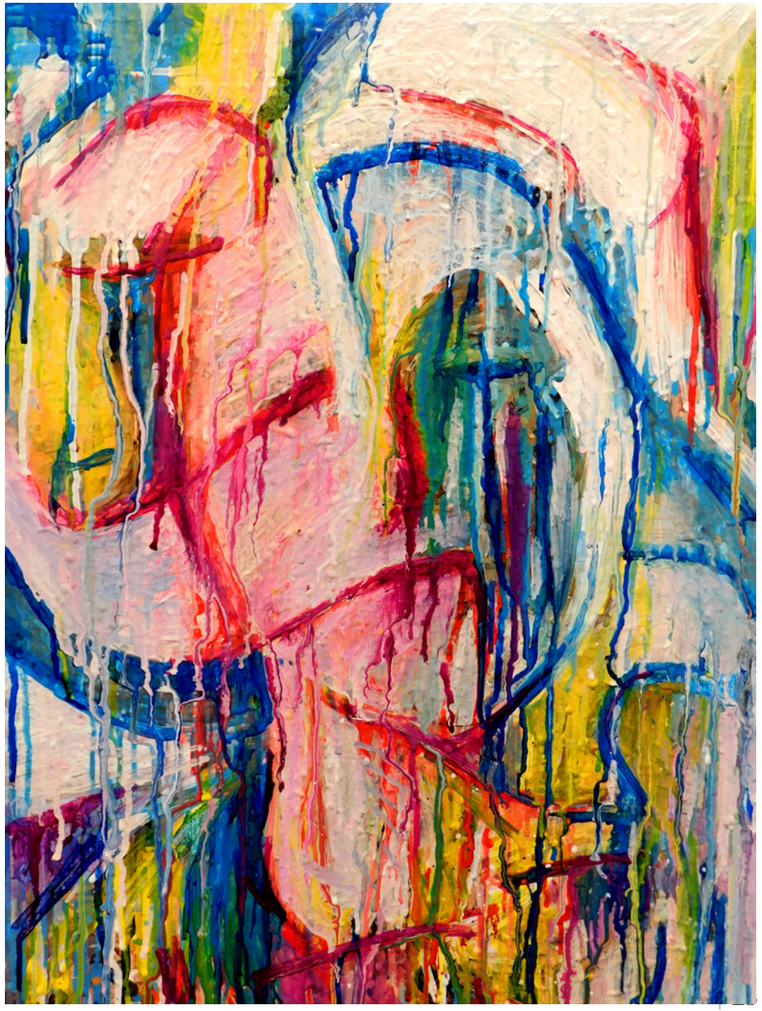


Photo by Marc Medina

Marina Esmeraldo

BARCELONA, SPAIN

This piece is part of an ongoing experiment called Bossa Landscapes, abstract compositions based on the observation of real things and landscapes, working from the principle that reality adds a layer of meaning and beauty I can't find otherwise.

The name of the series is a reference to the musicality and cadence the works impressed upon me, and draws inspiration from my native Brazil's musical genre bossa nova, where the term "bossa" referred to an aesthetic reformulation and a new way of doing things, based on the balance of simplicity and dissonance.

TOOLS

Copic marker
Paper
Pen and Pencils
Adobe Illustrator

"REALITY ADDS A LAYER OF MEANING AND BEAUTY I CAN'T FIND OTHERWISE."

Photo by Cam Floyd

Cam Floyd

LOS ANGELES, CA

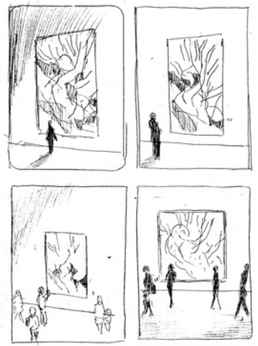
I really responded to Elaine de Kooning's unique balance of pure abstraction and use of observation in her work. Like de Kooning, who used a statue of Bacchus for her model, I decided to draw on Greek mythology too, using Bernini's sculpture, "Apollo and Daphne."

I liked how de Kooning merged the figure with the trees in the background to become one surface. This reminded me of Daphne, who was turned into a laurel tree. By emulating de Kooning's signature contour lines, I hope to subtly reference Daphne's tree in my own work.

In order to keep the piece from being merely a study of de Kooning's style, I added another layer to the piece by placing the image in a gallery environment that I drew in my own style. That is my attempt to show the conceptual challenge of interpreting another artist's work in a meaningful way.

TOOLS

Pencil
Sketchbook
Wacom Intuos 3 Tablet
Photoshop CC



"I CHOSE TO PLACE MY IMAGINED DE KOONING-ESQUE CREATION IN A MUSEUM GALLERY TO REFERENCE THE CHALLENGE OF HONESTLY INTERPRETING ANOTHER ARTIST'S WORK."

Photo by Sam Bufalo

Briahna Wenke

CHARLESTON, SC

This project is so fascinating to me because it touches on this underlying fear of mine–and many others–that technology will ultimately leave no room for us to simply be human. Painting taps into something primal, something most people let lie dormant for most of their lives. It reminds us of just how human we really are.

My main goal is to work through the mental restrictions we develop as humans. A robot doesn't struggle with self-doubt, or a lifetime of experience to work through. AI is given algorithms, structured guidelines and data and just needs to move its arm. It must be nice and easy.

When looking at the reference, O'Keefe's description of what she saw in nature helped guide my interpretation of Dreher Island, where I was an artist in residence. I tried to allow the space I was in, and its movement, to guide my hand. Likewise, Elaine de Kooning, who referred to painting as a verb rather than a noun, struck me. Because it's the process that feeds me, rarely the outcome.

TOOLS

Acrylic Paint
Wood Canvas
Palette Knife

"IT'S FULLY THE PROCESS THAT FEEDS ME, ONLY RARELY THE OUTCOME. AND THE OUTCOME IS WHAT FEEDS THE VIEWER, IDEALLY."

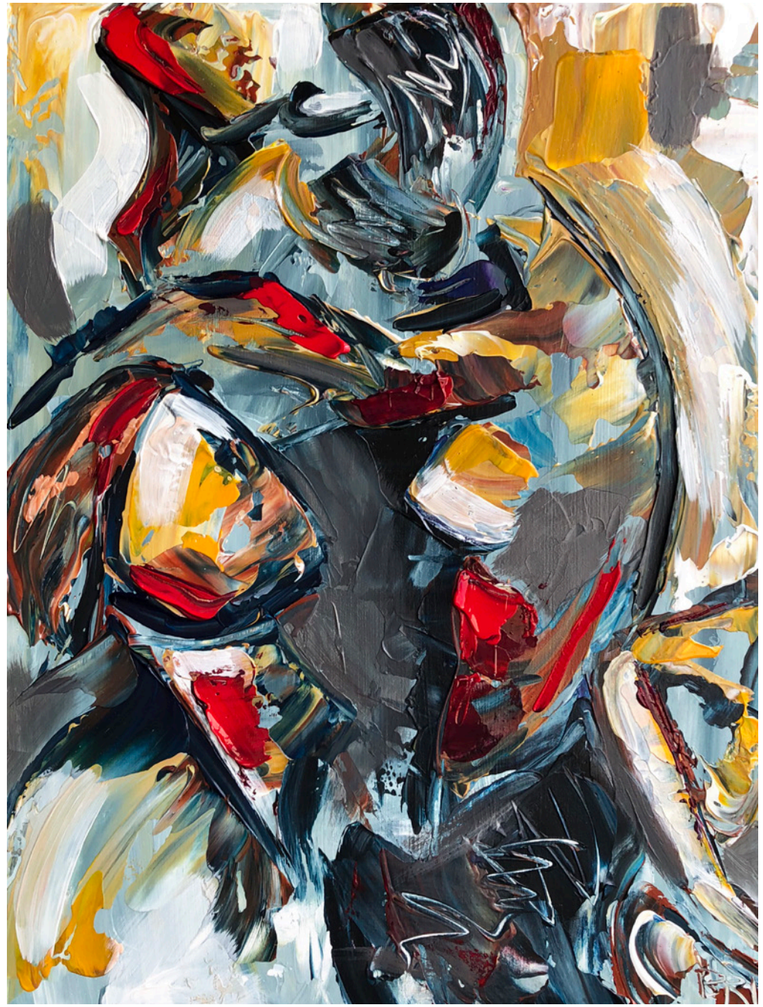


Photo by Daniel Cochran

Leandro Castelao

BROOKLYN, NY

Envision the future. Our eyes as the most powerful tool we have. Our thoughts interacting with the piece of art itself, transforming and recreating it. Like a non-stop looped creative dialogue.

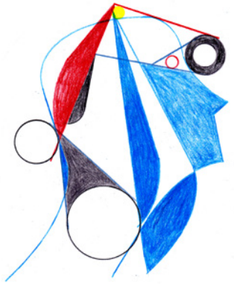
Technology will take abstraction to a totally new level and I wanted to talk about that with my piece. Possibilities will expand and create new art forms, things we've never imagined.

The piece highlights the relationship between an evolved human being trying to understand and learn from a piece of art that looks like a perfect organized chaos. At the same time, there's an active role between the piece of art and the viewer. In the end, the viewer is the co-creator, transforming, re-creating and changing.

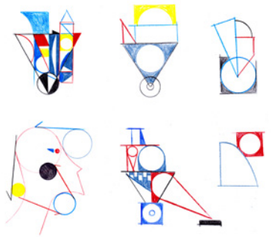
I believe taste will evolve and there will be multiple trends going on at the same time.

TOOLS

Pencils
Adobe Illustrator
Controlled Strokes
Geometric Shapes
Templates



"THERE'S AN ACTIVE ROLE BETWEEN THE PIECE OF ART AND THE VIEWER."



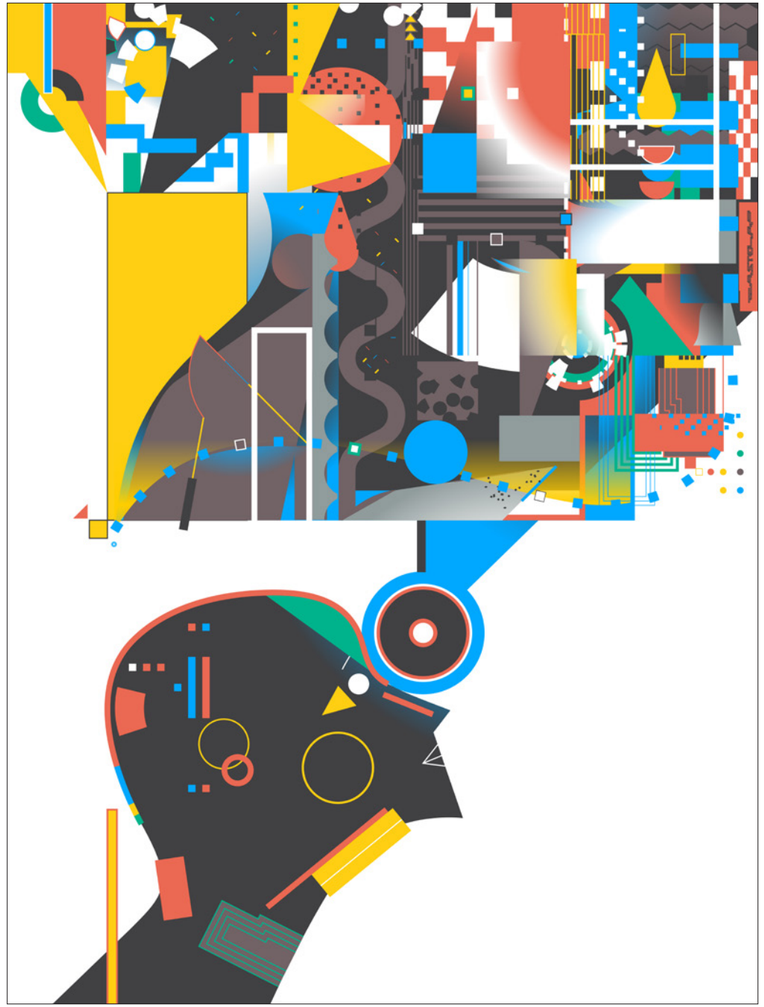


Photo by C_C Selfie

Computer Craphics, Inc.

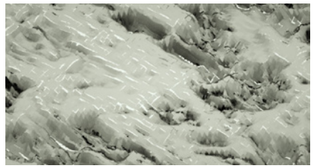
BROOKLYN, NY

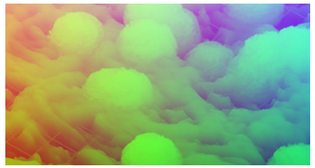
We started with playing around with some eye-catchy 3D imagery but then quickly realized that what we tried to create looked like it was designed by human artists for a human audience. When humans create, we're naturally drawn to pay attention to composition, a harmony of shapes, colors, etc. We thought computers might have a different idea.

We did research to find out where computer-generated art and data visualization are at this point in time. Then we looked for creative ways to integrate random and procedural objects and effects into our workflow. We reduced the amount we spent giving our own creative input and let computer algorithms help us make this final piece.

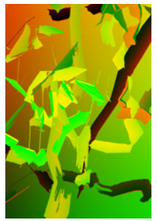
TOOLS

Unreal Engine +
Cinema 4D with xpresso
Random Modifiers/Tags
Procedural Deformers
Infochannels Output





"WE LOOKED FOR CREATIVE WAYS TO INTEGRATE RANDOM AND PROCEDURAL OBJECTS AND EFFECTS INTO OUR WORKFLOW."



HORSE & RIDER: THE FUTURE OF AI AND CREATIVE INDUSTRY

THE RUTGERS TEAM AND AI ARTISTS HAVE ONE VERY IMPORTANT THING IN COMMON: FREEDOM. ELGAMMAL AND HIS COLLEAGUES GAVE THEIR MACHINE FREE REIGN TO TURN OUT ANY IMAGERY THAT MET ITS PARAMETERS FOR "ART." LIKEWISE, VAN ARMAN AND HIS SET HAVE ONLY TO SATISFY THEIR OWN ARTISTIC IMPULSES. FOR CREATIVE PROFESSIONALS LABORING TO MEET THE EXPECTATIONS OF OTHERS, WORKING WITH AI BECOMES LESS ABOUT EXPERIMENTATION AND MORE ABOUT NEGOTIATION.

Creatives who want to know how they can harness AI to chart a new course might look to the stars. In 2006, NASA engineers faced a dilemma: Aircraft was becoming so automated that pilots were spending too much energy inputting commands and managing automation sequences. At the same time, they were lulled into a false sense of security by imperfect monitoring systems. The team posed the following question, "How do we balance between exploiting increasingly powerful technologies and retaining authority, with clear roles between humans and automation?"

The answer was the H-metaphor, a model for interaction with intelligent machines that is more like horse and rider than master and servant. According to the H-metaphor, much like a rider who trusts his horse to negotiate the terrain, humans should rely on machines for set and forget processes. But they should also have the power to chart the course and tighten the reigns, retaining big picture decisions and refining results to get to a desired outcome.

We see this metaphor playing out in the interaction between visual artists and AI now, and it may very well portend the future for creative professions destined to work with artificial intelligence. The future came early for actress Kristen Stewart, who found her name on a research paper about convolutional neural networks to artistically alter video in real time, a technique known as style transfer. Style transfer works by feeding an image to an AI system–VanGogh's "Starry, Starry Night," for example–then allowing that system to alter a second image to approximate that style. It's a technology at play in smartphone apps like Prisma and ArtistA.

For her short film "Come Swim," Stewart wanted to give her dream sequence the look of an impressionist painting. She enlisted the help of Adobe and Starlight Studios, who applied style transfer techniques to cinema. To get the exact look Stewart wanted, the team engaged in a back and forth with the AI, setting weights to the algorithm, allowing the computer to render the sequence, then refining their math as the results came in.

Unlike the Rutgers team, who gave their machine free reign to turn out any imagery that met its parameters for "art," Stewart's team kept tighter control of the process in order to guarantee the film had the right look. "In a production setting, a great deal of creative control is needed to tune the result, and a rigid set of algorithmic constraints run counter to the need for this creative exploration," wrote the authors of the paper.

Creative professionals want the reigns tight.

DULL, DIRTY, DANGEROUS & DEMOCRATIC

A creator's control over their work was never tighter than just before the digital revolution, when design, like art, was a physically demanding job. Artist Neil Powell, formerly executive creative director of a boutique ad shop, remembers coming up as a young designer in the mid-90s.

"I'm Generation X, so I wasn't brought up on computers. It was all done by hand. If we wanted to make a comp for a client there was no, 'Make it in Photoshop.' It was cut paper out, and cut the type out, and you use transparency through the Xerox to put it on top of the surface. Everything was hand-lettered."

Powell, who now handcrafts multimedia collage, hardly waxes nostalgic for the day. "Oh God. I would never want to do that again... Fuck that. Let's scan it and put it into Illustrator."

Considering what is now possible, that's setting the bar too low. Mainstay design software, like Illustrator, Photoshop and AutoCad, were developed in the 1980s. The advent of the personal computer democratized design by putting digital tools in the hands of creatives who had not mastered mechanical tasks. But those software programs still require a human hand at the keyboard or stylus almost continuously.

Rudimentary AI that's baked into newer tools are freeing designers of tasks like cropping, sorting and searching for imagery. Where junior art directors of the past would have spent hours tagging and sorting images, creatives wielding Adobe software can search thousands of images by color palette and depth of field, among other qualifiers. New AI-powered software eliminates the need for tagging altogether by instead using computer vision to scan images in real time and match them against selected parameters.

"If you are looking for someone's face and you want someone who is looking left or right, you can search for those things without having to manually organize it," said David Snyder, Executive Creative Director at Firstborn, a New York design agency.

Adobe's Sensei unit is dedicated to creating AI-enhanced tools that, among other things, allow image editing by voice command. The cloud-based platform monitors its users' actions for data, then trains the software to incorporate the best practices it learned into recommendations.

Google's Quick Draw works similarly. Its AI interprets users' scribbles, matching them against a database of vector-based images. A web-based game challenges users to draw something the computer recognizes in under 20 seconds. The crowd-sourced data set "can help developers train new neural networks, help researchers see patterns in how people around the world draw, and help artists create things we haven't begun to think of," according to the Quick Draw site.

Traditionalists may worry that freeing juniors from the drudgery of menial work might rob them of vital skills. Not so, said Roelof Pieters, a creative technologist at creative.ai in The Netherlands. In fact, used correctly, AI can help solve a talent shortage sapping creative industries of young talent and forcing companies to double down on recruitment.

"They treat junior designers as robots and they burn them out and then their challenge becomes hiring because everybody disappears after two years," he said. "That's actually the biggest problem of current professional design."

The democratization of time that AI enables is good for business. "Everything happens in a rush," Pieters said of the punishing pace and pressure of creative industry. "Everybody wants to have new ideas, and not only new ideas, but also variations." Given more time to hone their critical thinking skills, young creatives could contribute more winning ideas. And while automating mundane tasks allows more time for ideation, AI could offer more, he said.

AI is Your Next Creative Partner

LIKE COMPUTER SCIENTISTS, CREATIVE CHIEFS ENGINEER THEIR TEAMS FOR MAXIMUM RESULTS. THEY HIRE COPYWRITERS, ART DIRECTORS, UX DESIGNERS AND TECHNOLOGISTS THAT FIT THEIR PARAMETERS FOR TASTE, INGENUITY AND PERSONALITY. THEN THEY WEIGHT THEIR ALGORITHM BY DOLING OUT SENIORITY, ASSIGN BRIEFS AND WAIT FOR THE OUTPUT.

Max Fresn, chief creative at Born AI, is experimenting with an AI system that he hopes will be able to do exactly what those teams do. Like NASA's H-Metaphor, Fresn would set the course by programming the AI to solve a specific problem, then let the machine do its work.

"Instead of paying junior copywriters and art directors to give me a million bad ideas that I have to cherry pick and nurture, I can have an AI generate a billion shitty ideas that I can cherry pick and work on them myself," Fresn said. Considering AI's ability to search and process millions of visual data points, such an application would be imminently helpful when scanning the web for relevant reference, for example.

Fresn's work, however nascent, is not unlike that of AI artist Pindar Van Arman. Ultimately, he's creating a system in his own image, choosing the parameters and weights that suit his taste and priorities. These techniques are also being explored at creative.ai, where Pieters said his team is developing AIs modeled after particular team members.

"It's never 100 percent correct, but it's correct enough, because creativity is messy," he said. Such models would be better put to use training young creatives than replacing them, because they would give them access to artificial guidance modeled on their boss.

Practically speaking, these approaches lack the data to be workable in the near future. "Absolutely I see promise in terms of the methodology," said Fresn. "We need to figure out operationally how to annotate everything we push out so a computer can learn from it. Then you kind of need to run in the background."

In the end, programming your next creative partner is not unlike programming your robot artist. In either case, the intelligence may be artificial, but the creative spark and the ultimate agency is very, very human.

"Here's the problem," said Fresn. "I think most of the research tries to figure out the process by which we are creative. I don't think enough of it has looked at why we are creative. Nobody has been able to figure out how to give the AI a reason to do it."

Artists and computer scientists today are writing the code that will power image-generating AI for future generations. Elgammal and the Rutgers team gave their creation a wonderful running start by providing their algorithms with a limited art history education. Van Arman's algorithms approximate a more human creative, programming his robots to look at their work, consider it, then revise. Together, their work gets two-thirds of the way to qualifying as art.

But until computer scientists or artists can program AI to absorb inspiration, to crave communication, to essentially want to create art, the work an AI creates on its own simply can't be art without the intention of its human masters.

So, ART or NOT ART? NOT ART. At least, not yet.

Credits

AN ART PROJECT BY GUMGUM

Executive Producer: Ben Plomion

Author: Deanna Zammit

Creative Director: Bryan Bartlett

Design Director: Chris Mallinson

Photography: Johnny Shryock

SPECIAL THANKS TO THE ARTISTS

Pindar Van Armin | cloudpainter.com

Ahmed Elgammal | artrendex.com

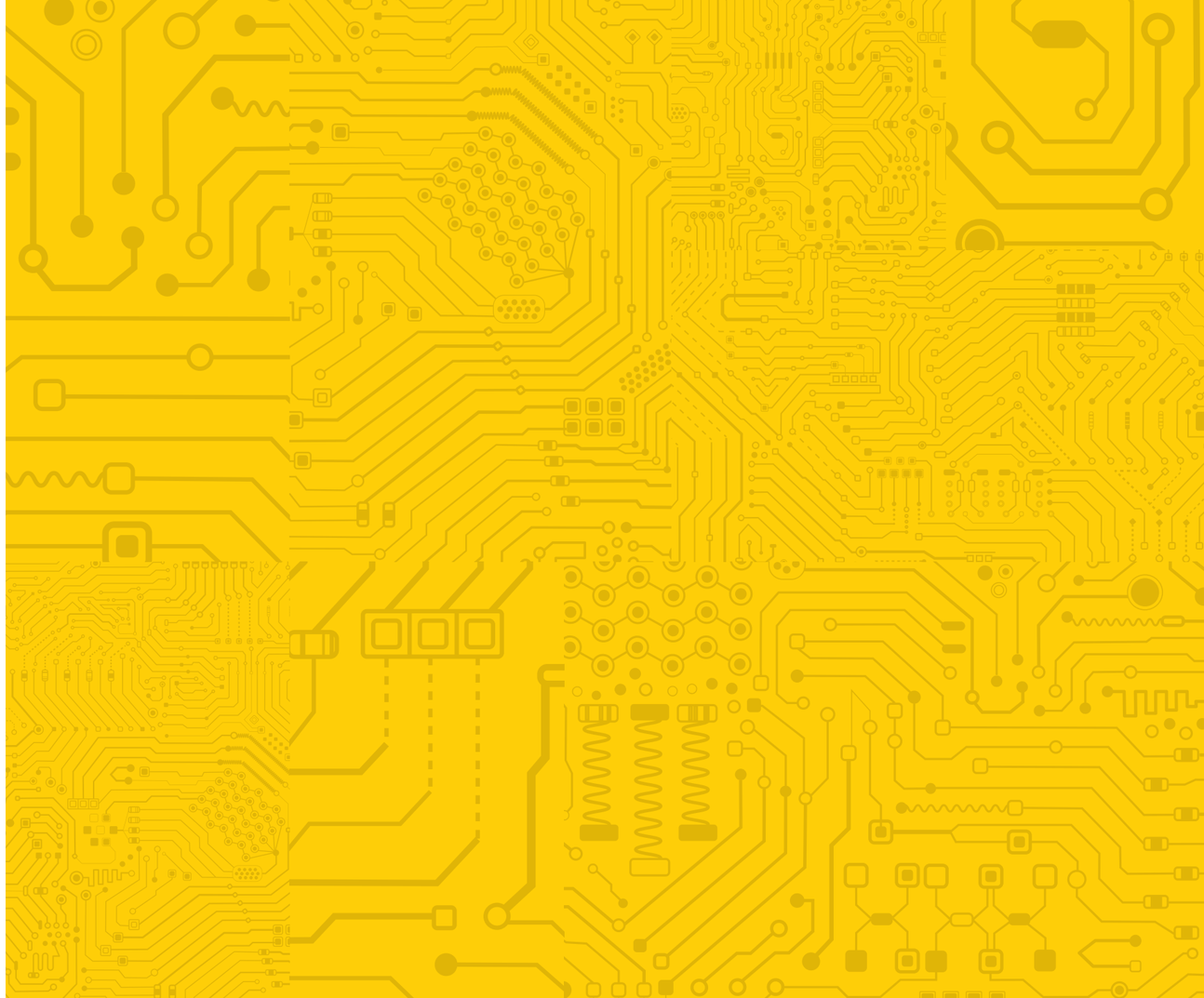
Marina Esmeraldo | marinaesmeraldo.com

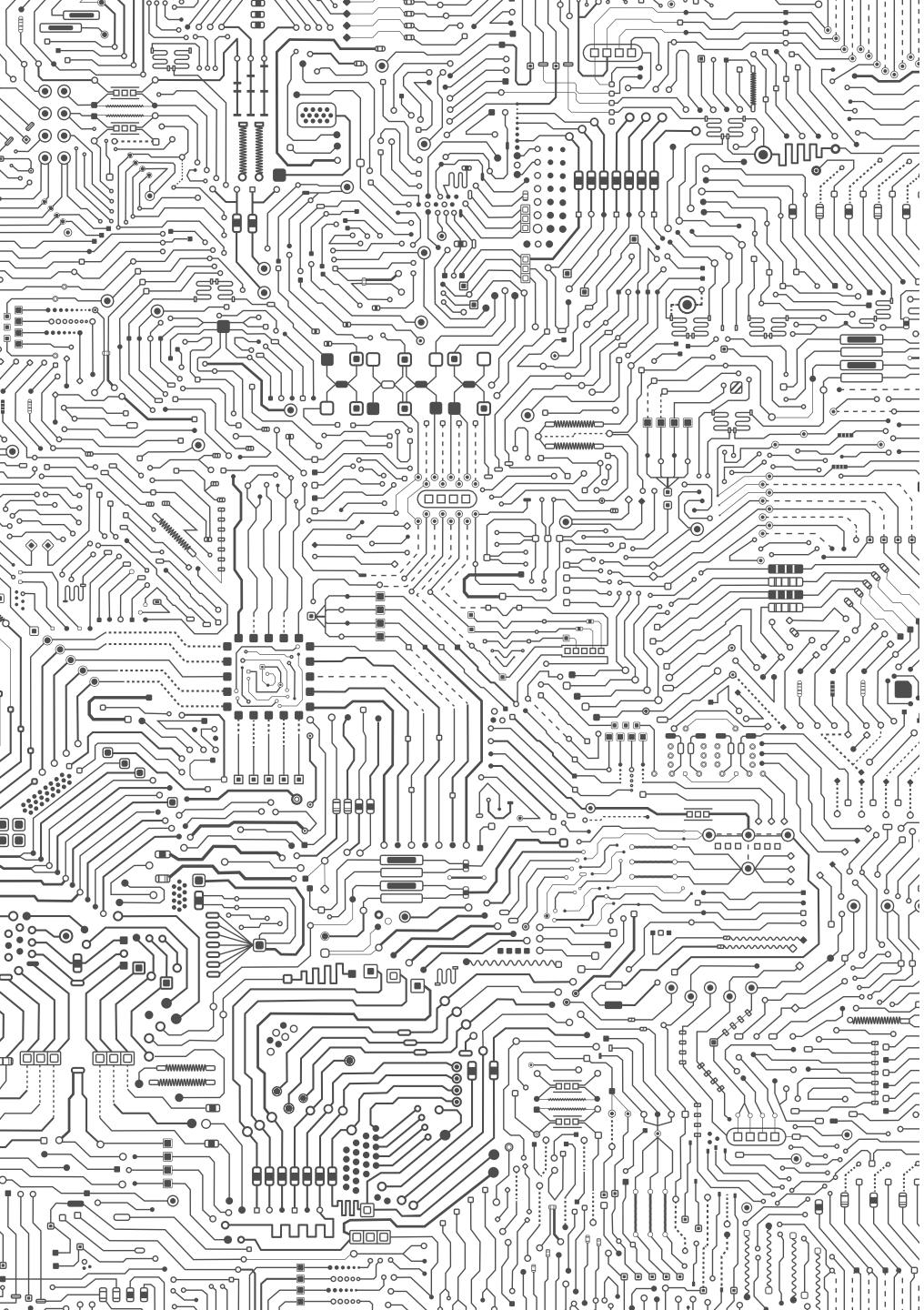
Cam Floyd | camfloyd.com

Briahna Wenke | artbybri.com

Leandro Castelao | studiocastelao.com

Andrey Smirny & Denis Sharabarin | computercraphics.com





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