The Age of the Fake— the New Normal

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The poet (Hölderlin) had it right: "There was never so much beginning!" *Théâtre d'Opéra Spatial*—the AI program behind it fully identified—got a prize (August 2022) at the Colorado State Fair. "Garden in the Machine"—painted in cahoots with adversarial neural networks—opened in New York (September 2022). The Kate Vass Galerie in Zurich announced a show, *Dear Machine, paint for me* (a take on Martin Kippenberger's 1981 work in New York) displaying works by Frieder Nake, Alex Mordvintsev, Manfred P. Cage, Ganbrood, Espen Kluge, and the late Herbert Franke. Behind these examples is the large language model (LLM)—machine learning that handles natural language processing, and databases of landscapes, portraits, and figurative and non-figurative art from many collections (the Met, among others). "Recite sentences that AI turns into images and you feel like an artist," so wrote on Twitter some of those who have tried the text-to-image technology. There is so much taking place that sites dedicated to what is cavalierly called "computer art" or "AI art" are literally choking.

The broader context is definitely more telling of what is actually happening than any set of examples (soon bound to be "old" stuff). Reputable publishers of scientific journals are faced with fake submissions. In some cases, visuals used as proof of experimental evidence turn out to originate in the machine learning procedures similar to those where the newest images vying to be recognized as art come from.

Remember the "Hitler Diary" euphoria of 1983? Konrad Kujau, a forger, set a trap into which the *Stern* magazine in Germany, as well as *Newsweek* and the *Sunday Times* of London rushed into with the same naivete as TV and radio stations that feed fake news to those no longer capable of or wishing to distinguish between the fake and the real. A movie—*F is for Fake*—documents forgeries since the time when they were morally unacceptable. Michelangelo, the great artist, presumably produced fake antiquities. Elmir de Horry (50 million dollars from cone art), Eric Hebborn (who painted copies of Breughel, van Dyck, and Rubens)—rebellion against those in power was his excuse—van Meegren, Wolfgang Beltracchi, and Ken Pereny—each outperformed the other. They chose anonymity—although their skills would have easily bought them celebrity status if applied otherwise. One more thing: China is folding the Shenzhen village of Declan operation that used to make, by hand, almost 80% of all copies of famous works sold in the USA and in Western Europe. The Chinese now prefer to invest in AI research instead of competing in the fake art market. One more detail: they request that AI-generated media (text, image, voice, video synthesis) be earmarked in order to avoid the spreading of fake messages and to protect legitimate rights.

Technological Performance vs. Artistic Relevance

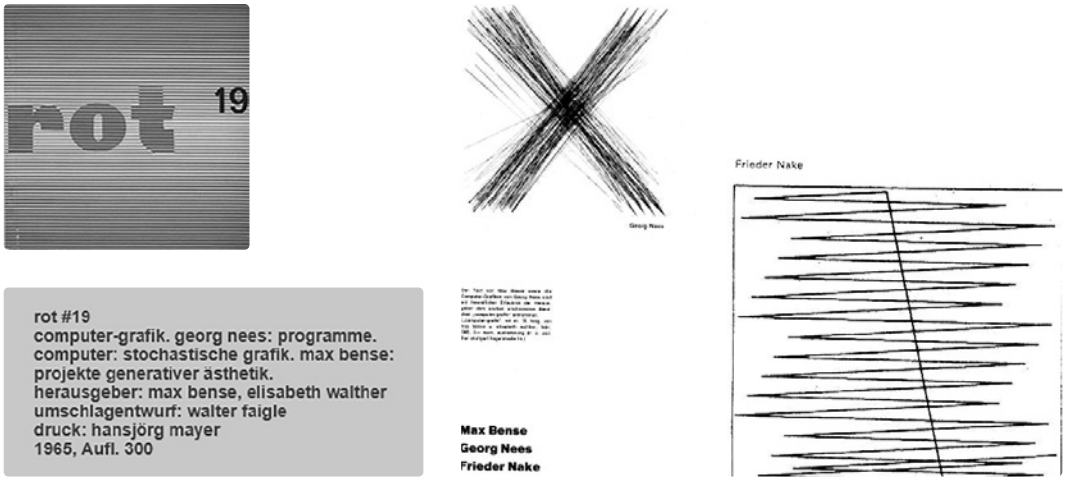
Creation—giving birth—is a seductive endeavor. Uniqueness, definitory of everything that is alive—there are no two identical cells among the hundreds of billions in our body—is not a caprice of Nature, but rather an existential necessity. Life is, by its nature, never-ending creation. Art, as one among the many forms through which the need

to know (oneself, others, the world) is expressed, can result in making artifacts (e.g., paintings, sculptures, photographs, movies), in texts and music, in performances (e.g., songs, movements, theater, games). In an ever-faster changing world of unprecedented technological innovation, art changes, too, not by some decree or aesthetic whim, but by *necessity*.

Survival explains the existential need to know. Art is one among many forms of inquiry. The outcome of artistic activity is an aesthetic expression of shared awareness. The ritual, the mythical, the religious are question marks of social relevance. Art is no less questioning of how the universe functions than the descriptions called *science* and *philosophy*. But instead of seeking the commonality of change in nature or in human nature, and expressing it through laws, art reveals uniqueness.

It is against this background of what makes art expression necessary that any new form of art can be analyzed. Passionate pioneers of computer graphics (from the early 1960s), attempting to properly frame their creativity, deserve respect for researching aesthetic possibilities connected to computation.

When, in 1971, Nake screamed: "There should be no more computer art!" (the title of his essay in the *Computer Arts Society Bulletin* [1]), his experience with the computer morphed into an ideological point. A lot was at stake. To make computer art, as he believed he was, implied to enroll in the defense of capitalism and support wars. Years before, in 1965, a student publication at the University of Stuttgart reproduced one of his early computer-generated images (as well as one by Georg Nees, Fig. 1) calling it "stochastic art."



→ Fig. 1
In 1965, in a series called *rot* (red), published by Max Bense and Elisabeth Walther, issue 19, was entitled "computer graphik." The Studenten Zeitung (Students Newspaper) reproduced images from this issue of *rot*.

Max Bense (Nake's professor) was, like his friend Abraham Moles (professor in Strasbourg), against speculative aesthetics. They offered the conceptual background of generative aesthetics, combining Birkhoff's mathematics and Peirce's semiotics. The alternative advanced: "measure" the artwork in order to understand it. Use the data from measurement and generate new art. The detailed quantitative description of the form—usually defined in semiotics and computer science as the *syntax*—together with operational rules for generating alternatives, is enough for rendering the outcome aesthetically relevant. That the same data could be derived from a work of art as well as from its copy was of no interest. They cavalierly ignored Walter Benjamin's warning about "art in the age of its mechanical reproduction." The age of the fake originates at

the meeting point of computation—i.e., the data-processing machine—and their generative aesthetics. With Bense and Moles (and their followers) the aura of art was replaced by the aura of data processing. It was the next step in the idolatry of the machines that originated within Descartes' reductionist determinism.

The Idolatry of the Machine

What became known as "computer art" is, for all practical purposes, nothing other than applications of computer graphics. This goes back to the 1950s: the SAGE system for air defense used visual representations of space. Ivan Sutherland [2] conceived the Sketchpad. Visual primitives (e.g., lines, polygons, arches), defined in the Bauhaus tradition, were made available for applications such as design drafting, but also for military applications. Vector graphics (supported by the 1965 IBM 2250), and eventually raster graphics (inspired by none others than the post-impressionists), enabled the modeling of objects. The focus on military applications was never made explicit. Sutherland, as well as Andries van Dam (Brown University), who taught almost everyone involved in computer graphics, are the pioneers of translating knowledge pertinent to perception of reality into images. Neither ever claimed recognition as artists.

The visual, as opposed to other forms of representation (e.g., the formalism of logic, the language of mathematical formulae, among others) facilitates different forms of understanding than natural language does. Visual language serves well in activities as different as medicine, design, chemistry, engineering, and, not surprisingly, war efforts. In this respect, it is quite telling that *Computers and Automation* (published by Edmund C. Berkeley since 1950), after discovering a "New Handmaiden of Aesthetics," launched an Annual Computer Art Contest. The winners in 1963 and 1964 are the US Army Ballistic research Laboratory (Aberdeen, Maryland). The images awarded recognition (e.g., ricocheting bullets) correspond to its mission. Eventually, Frieder Nake himself would get a prize. This was before his awareness of how computers, computer graphics in particular, became the underlying science and technology of all recent wars caught up with his revolutionary enthusiasm.

The ideological position that Nake takes—no more computer art—reflects his political profile. His aesthetic choices correspond to a view anchored in an aesthetic devoid of its core: meaning abandoned in favor of measurement. One of Nake's favorite modern artists is Sol LeWitt. For him, Conceptualism (with which he identified) meant "all the planning and decisions are made before hand and the execution is a perfunctory affair," [3]. The sentence: "The idea becomes the machine that makes art" defines algorithmic art by an artist who did not use computers.

Artists, always eager to expand their investigation of reality—as they did when photography, for example, and later filmmaking emerged—did not hesitate to experiment with Sutherland's Sketchpad, or, like Nees, Nake, Noll, and many others, to take up the challenge of "talking" to the machine. Harold Cohen was one of such artists, as Manfred Mohr still is. Regardless of whether they used programs written by others (such as Shaffer for Csuri) or attempted to program themselves, somehow one question in particular regarding the results gained from interacting with the new machine could not escape their mind: *Who* is the artist? In Harold Cohen's home, he and I debated whether, after his life ended, whatever "Aaron" (the machine) would output would be

his art. Selection from among the many variations of an image was, in his view, part of the creative process.

Of course, Nake, like many others, asked whether there was any accomplishment in the "computer art" domain that qualified as exceptional (commercial success or not): "How far away are we from the first masterpiece of computer art?" [4]. Jasia Reichardt [5] noted that the effort "produced nothing so far that can be called a great work of art." Again Nake [6]: *Und wann nun endlich "Kunst"-oder doch Lieber nicht?* (And when, finally, art—or better yet not?). In other words: Is it art, or better let us stop kidding ourselves? Those passionate about experimenting with the newest technologies often question their own efforts.

Questions from individuals sincere in their efforts to become artists populate discussions on social media. Suddenly, they are able to generate images using machines that "translate" their words into paintings—actually matching language patterns to images in vast databases. But they have no idea whether what they do qualifies as art. They expect others to make this call, or to qualify them as artists. There are already machine-generated short films posted on the world wide web; and games, many games. "Pretty crapola" said an art critic known to be open to experiment and innovation. Aesthetic junk, maybe not at the scale at which it can be generated using computers, is nothing new within culture. It is inevitable, as much as scientific and technological junk is inevitable. But is the hope for good art automatically generated through faster and more sophisticated machines also inevitable? The cost associated with exploring automated art-making has yet to be acknowledged.

Within the now no longer extant ATEC School (at the University of Texas at Dallas), I carried on an experiment involving more than 1,000 graduate students, for almost eighteen years. The assignment: *Is an aesthetic machine possible?* To the best of their abilities, they produced prototypes and posted their presentations on YouTube. If anything, the realization that, so far, such machines did not produce art was pretty much unanimous. It's good to know what does not seem possible.

To acquire knowledge—which is the ultimate purpose of artistic endeavors—no matter in which form (scientific theories or works of art) is a noble task, but not necessarily always successful. Many Nobel prizes inadvertently recognized junk (remember the award given for the science that led to lobotomy?). Throughout history, the Masters, i.e., the successful artists, often produced junk—and disposed of it with the same fervor they used in promoting what was successful or in getting more patrons. Therefore, to evaluate the outcome of the computation behind the increasing number of attempts to automate the making of art by comparing it to what is acknowledged as art is a futile exercise. Given the particular nature of art, the question is whether the dominant form of computation today—i.e., the algorithmic—can result in art, exceptional or not. After all, art is justified by the interactions it triggers. Its meaning is the outcome of such interactions, changing over time as the human itself is continuously changing.

The Impossible—Is It Only a Matter of Time?

As a preliminary, a short comparison: The mechanical contraption we call a photo camera, and its digital implementations have in common "Painting with light." Today, everyone "takes pictures" without automatically becoming artists. Albeit, everyone can now have access to a program that a text command turns into AI images. Before that, TikTok, with its machine-learning-based algorithm turned lyrics into songs. The machine illusionist is not hiding its secrets—it is not the art that wants to be celebrated, but the machine. As artists, photographers capture knowledge of the uniqueness of a person, of a landscape, of a thought, of shapes, etc. They do not merely record impressions of a vacation or a graduation. Photography expanded the aesthetic space: the invisible, the remote, the intimate. It made new creative experiences possible.

Change itself can be investigated with the benefit of shedding light on meaning. Computer-generated images (and for that matter sounds or 3D-printed objects, games, animations, etc.) exemplify new production means. The aesthetic space available to those who use computation (including AI) is that of the past: data is always a description of what was, including the art of the past. Comparing the impact of photography and of computation supported artistic endeavors, prompts one clear-cut questions: Is creativity possible in algorithmic computation?

"Squaring the circle" is the classic example of an impossible task: *In a few steps, construct a square with the surface of a circle, using only a compass and straightedge*. The mathematical proof boils down to π being a transcendental number. It turns out that the Turing machine—the mother of all algorithmic machines—is the result of yet another impossible task. It was formulated by Hilbert and Ackerman [7]: Is there an effective procedure which, given a set of axioms and a mathematical proposition, decides whether it is or not provable from the axioms? No one interested in whether computer art is possible would read this challenge—how to decide upon a mathematical proof—as having anything to do with whether "computer art" is possible. But the provenance—the origin, the record of ownership—of the question of whether computer art is possible, or even whether the automated making of images qualifies as art begins with a mathematical challenge. Although the type of knowledge acquired mathematically and the type of knowledge acquired in artistic endeavors are different, there is art and uniqueness in both. Questioning defines both. Therefore, the *Entscheidungsproblem*—the decision problem—is relevant to art as much as it is to mathematics. Turing (in the footsteps of others) demonstrated that the *Entscheidungsproblem* cannot be solved. His paper, "On Computable Numbers, with an application to the *Entscheidungsproblem*" [8], describes a way to deal with anything that can be described through a recipe (*algorithm* is the fancier word). The yes or no of a mathematical proof cannot be derived from a recipe, i.e., it is not an algorithmic procedure. The Turing machine contains every machine that works on recipes: all the typewriters (reduced to word processing programs), all calculators, all pencils and brushes can be reduced to algorithmic computations. All imitations—TikTok or stable diffusion, not to mention DALL-E-2 (or whatever comes next).

For everything of a deterministic nature, for which we can identify a cause and an effect (the "recipe"), the machine delivers a testable description of its functioning. It cannot determine—the impossible aspect—whether a proof is right or wrong in a limited time and a limited number of steps. This is not a provisional limitation,

but the necessary consequence of the premise upon which it was conceived. Mathematics and, for that matter, the arts are by their nature non-deterministic activities; that is, the same cause can have unpredictable outcomes. Thus, it is unsurprising that algorithmic computation would not suffice for deciding to what extent something is mathematically right, or, for that matter, artistically meaningful. The art of Jackson Pollock, of Mondrian, of Picasso and of Jasper Johns exemplify this thought. They are discoveries that no description, no matter how detailed, can substitute. Their *raison d'être* is their ever-changing meaning—the interactions with viewers of our time are different than those of times past. They derive their living nature from such interactions. Let us translate these considerations of logic and mathematics into the specific subject of "algorithmic art" (yet another name for "computer art").

Of course, art is not a mathematical proof. Moreover, art is not the translation of reality in the broadest sense of the word, i.e., including the reality of thought, emotions, and of art itself. Art is rather its unique interpretation. Art conjures meaning where science seeks and demonstrates truth. The Turing machine has only a syntactic dimension: there is no meaning in the sequence of the two letters of its alphabet (zero and one). There is no pragmatic in computation: it can process the trajectory of a falling stone, of a bullet in the air, of the flight of drones, regardless of the WHY? of their movement in time and space. The WHY? of art is driven by the pragmatic. Its formal aspect, i.e., the aesthetics—its language—as it is sometimes defined, becomes essential in reaching its goal. To know in terms of art is to engage its public in the questioning. To interact with a work of art is unavoidably to make it again, with the purpose of understanding it, in the context of its perception. Picasso's *Guernica* in the context of World War II, made possible by the industrial age, and in the context of the wars made possible by computation, triggers different questions. Searching for what the artist meant (the artwork as a riddle) is as illusory as explaining who we are by examining the genome of our mother and father. *We are what we do*, not what we are made of—although what we do is in many ways conditioned by our make-up. Art is what it means, not the data describing the matter in which it is embodied and transmitted. There is no authority—critic, theoretician, politician, investment advisor, etc.—who can decide what is art and what is not. Art is what artists have made it to be over time, regardless of how their work was described in theory books, or what technology assisted them.

"Computer Art" Is "Campbell Soup"

Let us unpack this subtitle: Computer-generated artifacts—music, images, objects, multimedia, games, etc.—are as much art as "Campbell Soup" (or that of Heinz, Kraft, Nestle, or Maggi) is soup. Of course, the immediate reference here is to the art of cooking: the soup our mothers, grandmothers, and sometimes fathers and grandfathers prepared: liquid food, reminiscent of bread soaked in some sauce, as the etymology of the word suggests. Never the same, even though the recipe that everyone wanted promised a repeat. But it was not: the water used is different, the pots are not the same (some carry the taste of previous cooking experiences in their material), a pinch of salt added after tasting, some spices, another boil. It is *Repetition without repetition* (a formula that N.A. Bernstein [9] used to describe how the human motoric system works). This rather innocent observation inspired the provocative label "canned art in a discussion disclosing my enthusiasm for the possibilities opened through computer graphics (SIGGRAPH 1985) [10]. I chaired [11], "On the Aesthetics of Computer Graphics." Hiroshi

Kawano, Frank Dietrich, Charles Csuri, and his assistant Tom Linehan (a genius of art administration) joined me in a conversation that upset Silicon Valley entrepreneurs more interested in monetizing computer graphics (the military were active in funding it) than in promoting a new aesthetics. For the record: established artists at the time considered computer graphics with interest, but were rather reluctant in changing their art. It was not worth the effort of learning how to use a computer program—never mind how to express, in the miserable programming languages of the time, what they would expect a machine to do for them.

Barbara Nessim was attracted by computer graphics (Fig. 2), as was Nam June Paik and, later, David Hockney, not so much because they could accomplish aesthetic goals otherwise not attainable, rather because they searched for new means of expression.

→ Fig. 2
Rainbow Shower
© Barbara Nessim, 1982–1984
(reproduced with permission).

As artist in residence at Time Video Information Services (TVIS, 1982–1984), she learned how to use the Norpak machine, to which she had access. The interface: keyboard, stylist, tablet. Available shapes: arc, circle, rectangle, line, polygon, dot. You had to build the image in layers, from the background to foreground. At that level of technology, the machine was "using" the talent of the artist. It was a rather poor palette; instead of pigments, it offered a limited number of light colors and a rather crude resolution. Everything accomplished using the program could have been done by hand faster and better. Ultimately, Nessim's art won over: it benefitted from the discovery that "Less is more."

But nothing concerning the pioneering stage compares to what takes place today. At the main Zurich train station, anyone (and their dog) can come up with phrases (the more ridiculous the better) that are made into images by some online AI shop. What is produced is fake art. It looks like whatever is imitated, but it is empty of meaning. And thus, by necessity, obsolete from its inception. A game of chasing after novelty. Addiction to the disposable, which originates in the economy of consumption, is replacing the ideal of permanence. The knowledge acquired through automated digital processing becomes obsolete as each new artefact is disposed of as pictures taken with digital cameras are forgotten before anybody else would care to see them.

Almost all the machines of the past—the hydraulic (set in motion by falling water), the pneumatic (moved by air pressure), and the electric—were of interest to artists. Mostly, they could (and indeed did) help in the making—"production," as it is called—but not replace the creative effort. The tools themselves were expressions of knowledge (mainly physics), but not of the kind that the artist discovers while adding new realities to the reality to which they belonged.

Freedom of Expression Is Defined in Context

There is yet another aspect of the beginnings of what eventually became known as "Computer art:" freedom of expression. Machines utilized in the process of artmaking afford freedom, but mostly in relation to the physical effort involved: the techné, the making. Not unimportant, if you think of what it took not only to build the pyramids, or to assemble the Terrace Army at the Emperor Qinshihuang's mausoleum, but also to paint the frescoes decorating many church ceilings (Michelangelo painting the Sistine chapel), or, more recently, to make Richard Serra's large metal sculptures possible. However, freedom of expression goes beyond the production of art. It pertains to the knowledge it makes accessible, more precisely to the meaning it conjures. Art, more than science, and in ways different from science, disclosed meanings provocative in nature. It became a form of resistance to all kinds of oppredsion, including that of established rt and of conformist aesthetics.

Evidently, 1965—the year the first shows of computer-generated images—counts as a time reference for a provocation. In Stuttgart, the first shows on record took place at the Studiogalerie of the Technische Hochschule and the Galerie Niedlich; also in 1965, the Howard Wise Gallery, in New York, held a show focusing on the machine's performance. Even the simplest computation (intersecting lines, circles, polygons, etc.) was celebrated as an alternative to hand drawing: "You cannot draw a circle. No problem, the machine will do it for you." Skill was to be substituted by technical performance. This would, as was claimed, democratize art. No more just a few—artists (i.e., privileged white individuals, mainly males, according to today's jargon)—but everyone could make it. As is known, some masters of the past had their "production" facilities—students eager to learn from them working on large compositions. In recent times, Vasarely (of op-art famous after WWII) comes to mind. He ran a *factory*-like studio employing many assistants who executed, by hand, programs of "paintings." It was a system of numbering grids, like a color code on a pattern, with numbers at the location of the square backgrounds. The algorithmic machine could be programmed to mimic, artwork. This kind of "freedom of expression," prophetically captured in Walter Benjamin's *The Work of Art in the Age of Mechanical Reproduction* [12], is echoed today in the text-to-image frenzy of AI generated "art"—mechanical indeed. Unfortunately, Benjamin's thoughts, often celebrated, are ignored. The visionary (exiled in Paris during Nazism) warned about the dangers of submitting to technology. It is not the lost aura that the art community should be concerned about, but rather the abandonment of values in favor of success.

While in the advanced West you could experiment (within the limitations of art economy), in the Soviet empire, things were somewhat complicated. In Eastern Europe, where official art was encoded in the rules of socialist realism (anchored in the dominant ideology) making images with machines was a way to shake off the handcuffs. For those seeking freedom of expression it meant the opportunity to express what was officially not acceptable. The knowledge that art reveals is not always comfortable, neither to the public nor to those in power. The use of computation opened a way to get around censorship. You could not attribute intentionality to machines. Of course, only those few who had access to computers—the state owned them—could experiment. Those wishing to use them needed to be certified by the secret service as posing no danger to the system: the privilege of being vetted as trustworthy. In the works of Vuk Cosič, Vladimir Bonačić, and Edward Zajec (more names, and not only from Serbia and

Croatia, deserve to be remembered) what counted was way more than the formalism of computer graphics. They were "researching" the visual before the visual became the dominant means of communication. Being subversive in a society in which to be subversive—as art always is—was a crime.

This is not the place to rehash or rewrite the history of computer graphics, or that part of it that claims the identifier "computer art." But it is the place to contrast innovation as a new aesthetic formalism, and innovation as a new way to convey aesthetic meaning. The focus was on searching for means of expression free of political and ideological pressures. Seeking aesthetic freedom by adopting the new machine was more than number processing and translating it into plots on paper. It was in opposition to what the regime (in the Soviet Union, Romania, East Germany, the former Yugoslavia) promoted. It was dissidence—a qualifier usually associated with writing (Solzhenitsyn comes to mind, but many others—the *Samizdat*—circulated their works of opposition to dictatorship).

In general, attempts at generating computer images connect to the revolutionary art of Malevich, Moholy-Nagy, Tatlin, and so many others in the so-called socialist countries. The New Tendencies (NT4 and NT5) and Visual Research (1968–1969) were driven by issues of creativity. Generative processes, associated with those movements, were deployed in pursuit of creativity. Against the domination of technology, Boris Kelemen, in the Catalogue "tendencies 4", Zagreb 1970) and seeking "an alliance with the most advanced research in natural and artificial intelligence," (the Zagreb Manifesto, 1971) is an example. Such goals testify to awareness of possibilities, but also of dangers. In the hands of artists—Sherban Epuré is one example I am familiar with [13]—computers were supposed to become part of their creative process. It was not the algorithmic output (recipe-based art and automated production) that made a difference. The goal was freedom, the artist's liberty to integrate a new way of thinking, outside the prescribed ideology, in the creative process.

Boiling the Oceans: The Obsolete Is Expensive

To make "computer art" feel like human art, the false prophets of those days theorized that they need some aleatory component. Therefore, another machine (random number generator) was supposed to make the art-making machine seem more human. In the absence of understanding what art is and why creative individuals identify themselves through the specific knowledge that their art shares with others, theories were advanced regarding the description of art through data. They were based on "information theory"—Shannon's genius at work solved a military task: how to get data safely from one point (command) to another (executor). It became known as "information theory"—a misnomer as confusing (and dangerous) as "computer art." In reality, Shannon's "information science" was "data science," devoid of meaning, as Shannon himself pointed out. It states that the thermodynamics of data transmission (electrons traveling through wires, or electromagnetic waves propagated in the atmosphere) affects the process. In other words, it describes the physics of the process, including the role of "noise," which is independent of what the transmitted data stand for.

The core of what in our days became the new obsession: Describe in language what you wish to make into an image. AI will do it for you based on data that describes

images (used to train neural networks). This is the semiotics underlying the process. The larger the collection (amazingly large databases supposed to be the visual memory of humankind), the better. Brute force at work—regardless how much energy is consumed. A first reaction to what it takes to accomplish the task came as a tweet to my account: "For me, the question of AI is not 'Can this make good art?' but 'Can this make art so good that it's worth boiling the oceans for?'" Many, artists in particular, are concerned that the breaking of an iceberg off Antarctica might lead to ocean levels rising two feet over current levels. But they seem less concerned over the breaking of aesthetic dumpsites: all the libraries of image recycled by ever faster machines. Sustainability, in terms of using huge amounts of energy—an image generated in the text-to-image sequence has a large footprint—can easily be quantified. But the danger of mediocrity, generate at a rapid pace, is more insidious. Instead of innovation, the automated production of meaningless images generates more landfill waste affecting the cognitive and emotional profile of those who are subjected to the invasive outcomes. Let us try to understand what is expressed here—assuming that authentic sustainability, which integrates awareness of value, is of concern to society, and not just a slogan in fake, opportunistic political discourse.

Reporting on a painter (the qualifier was left ambiguous—was it someone who paints homes or someone who is an artist?) the *New Yorker* (Petrusich 2022) took note that he generates interpretations of other images ("usually culled from cheap art books") at a pace of 60 and over per day. The public can order (ten bucks a piece) from his website. No way to choose—the client gets one work from among those available. Of course, it takes energy to produce over 300,000 such items in a life-long dedication to making them. There is no reason to compare this production to what various versions of DALL-E, MidJourney, Stable Diffusion, etc. output. In the train station in Zurich (who knows what other "terminals" at airports and in shopping malls offer the same), passengers can "make art" by requesting, in natural language, whatever they describe. Walter Kirn (2022) gave one example: "a tarantula wearing a green scarf." You can tell the AI to render the tarantula in the style of a cubist drawing or a vintage photograph, or even a Soviet propaganda poster. (In China, the image would carry an earmark—AI made—in order to prevent misunderstandings!)

By 2016, AlphaGo had beaten everyone playing chess. For this it used up the energy that a whole town consumes on average. The fact that in the process of playing all games possible (Shannon calculated that there are not more than 10120 possibilities), the AI chess program practically did away with chess—while burning a huge amount of energy—was never brought up. Check out the saga of the recent chess game in which a young opponent (Hans Niemann) of the world chess champion (Magnus Carlsen) is accused of playing like a machine (and his body searched for possible micro-transmitters). Playing like a machine is the equivalent of painting like a machine.

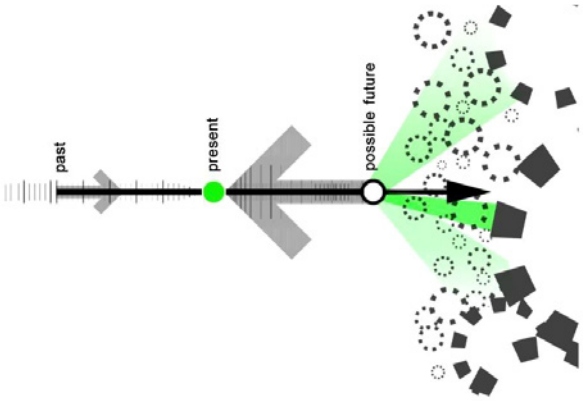
Chess, as we know it within culture is finished, whether we like it or not. Is art, exposed to brute force methods for making images from other images, also finished? In the same context, the courts are examining whether Andy Warhol's "Purple Prince"—an interpretation of a photograph by Lynn Goldsmith (license for use dutifully paid)—fits in the "Fair Doctrine Use." There is an "Orange Prince," and there are more interpretations signed by Warhol, not unlike what AI does, as it chomps on huge image databases that translate texts into images without any authorship attribution.

Remember Nake's ideological call, "There should be no more computer art!" that led to a pretty passionate discussion about computers and art? Of course, the answer to the many questions associated with change—in science, technology, in the human condition, in economic activity, in wars, in sexuality, in our understanding of "gender," race, ethnicity, privilege, etc.—is not to stop, or to forbid something. Or to earmark! Hilbert, whose challenge (the decision problem) led Turing to discover the seeds for the algorithmic machine, believed that every mathematical problem has a solution. "We must know, we will know." (These words are chiseled on his gravestone.) Artists act in the same spirit. Machines or not, what counts is the meaning unveiled through interactions between art and those whom artists are trying to reach. In the spirit of optimism, let us advance, through a rather tight argument, the idea that in order to know what all these changes are bringing about—so much more lies ahead—we will unavoidably readjust our perspective. In the new system of values associated with the automated production of art, or with the substitution by NFT of art itself, obsolescence replaces permanence. Is this also the end of intellectual property? An address on the chainlink as proof of authenticity? The end of commoditized art? Don't wish for a revolution if you are not prepared to live with its consequences. Many heads fell in the American, the French, and the Russian revolutions.

Art Is Consubstantial with Life

There are two distinct conditions of planet Earth: before life, and after life emerges. Not a clear-cut moment, rather a long-term process. Everything taking place before life—such as the making of the elements, or the functioning of the universe—constitutes the knowledge domain of physics. In retrospect, i.e., looking back from the perspective of what we know so far about change in the non-living—the physical universe—such phenomena are decidable. This means that they can be described fully and consistently. The laws of physics are an example of such descriptions. Based on them positions of planets are defined precisely, and space exploration became possible. But once life emerges, change in the world is no longer only a matter of coordinates in space (describing their movement), but also reproduction, i.e., survival. The offspring is never the same as the progenitor. The physical is defined by its sameness: gravity, for example, does not multiply, it has no offspring. Neither do stones. The living is defined by change that ensures its continuity: it reproduces, but never in sameness, rather in uniqueness. There are no two living entities, from Aristotle's blades of grass to human beings, that are identical. Therefore, as John von Neumann—the visionary of the age of reproducing machines—observed, the living continuously becomes more abundant than the non-living. This in itself suggests that a complete description is, if not impossible, at least not within the ability of an observer, whose own life is limited. Moreover, the living is "undecidable": it cannot be completely and consistently described. The dynamics of life, how it changes, is contradictory. Think only about *archaea* surviving in the most noxious environments (extremely hot, i.e. more than 100° Celsius, extremely cold, acidic, alkaline, salty, deep in the ocean, even bombarded by gamma or UV radiation, etc.). Never mind human behavior: from cooperation and solidarity to aggression and war. Unpredictable. Art is one of the records of this dynamics. Probably the most faithful, since it reflects what it means to be subject to change, and awareness of it. In this sense, art is knowledge about the meaning of emotions, feelings, thoughts. Awareness itself is entrenched in what artists do and, more important, in why they commit themselves to creation.

The fact that everything not alive can be described as decidable, and everything living escapes decidability is not sufficient for explaining the fundamental difference between the living and the non-living. Life is by necessity creative: it gives birth to more life. The nature of the process through which this takes place is more important than the outcome. The change of the physical can be described in terms of a form of causality defined as determinism. Let's say "How does a stone turn into sand?" For this we need to describe all forces at work in grinding the stone. The dynamics originates in its past. The living, bearing the past as its history (or biography) is driven by survival, which means *possible future*. For the deterministic view of change of what has no life, a description of how it changed position or shape suffices. Based on deterministic science, human beings were able to land on the moon, not to mention that they conceived and constructed all kinds of machines for the sake of prompting more change. For the non-deterministic condition of life, descriptions of change as non-decidable imply that together with the physics of action-reaction, we need to consider the biology of anticipatory processes (Fig. 3). This is not only the origin of life, but also the origin of art, and of all other forms of inquiry based on which survival takes place.



→ Fig. 3
The current state of an anticipatory process depends on past states (which cannot be changed) *and* possible future states (an ever-changing multitude).

The living is aware of its own life and of the environment in which it unfolds. Anticipatory processes, at all levels of existence (from the cell to organisms to societies), are at work in order to make survival and reproduction possible. To know, in various forms, is the pre-requisite of survival. In reference only to the human being—but with the understanding that all forms of life are defined by anticipation—all activities carried out (hunting, foraging, tool-making, settling, etc.) are forms of knowledge acquisition. Art is a particular way through which to know becomes embodied in means of expression that correspond to the continuum of sensorial perception. Sounds, rhythms, shapes, colors, textures, taste—the synergy of everything perceived—nurture expressions of knowledge that range from elementary interactions (such as sexual preferences and behaviors, to cave paintings, as they are called), to whatever else shapes humankind's evolution. Art is not a cause-effect phenomenon, but the outcome of a multitude of ever-evolving anticipatory actions.

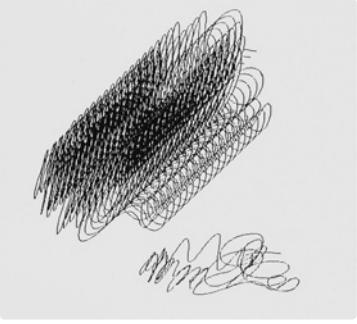
Art Enriches Reality

One more thing: phenomena of physics can be explained following the reductionist scheme of segmenting the whole into parts that are easier to understand. Life phenomena are holistic: they can be understood only in their wholeness, kept together not by the material make-up, but by their evolving meaning. Indeed, art is alive; it evolves

as humans do. The life of art comes from interactions between art works and those willing to remake them in the experience of art perception. The fact that what most of what produced as art, or intended as such, is doomed, i.e., end up as waste in landfills, corresponds to the nature of artistic activity. Inquiry cab be inspiring or it can lead to a dead end.

What does all of this have to do with Nake's call, or with the fact that we are experiencing an orgy of AI art that is anything but? What does it have to do with the fact that the aura of the fake surpasses awareness of the unique, the original? Remember, squaring the circle is an example of what by its nature is an impossibility. No matter how much faster computers might get, and even how much their energy consumption can be reduced (to avoid boiling the oceans), algorithmic computation will never result in art. The fake is not replacing art but constitutes as by-product of machine-supported human activity. Even the replacement of the human being—the robot called *artist*—by machines is part of the same process. Deterministic processes can, at best, reproduce or mimic what was—the past—but never result in anticipatory processes. Art is not the reflection of the past—even when it subject is history—but the making of the future. In the absence of anticipatory expression, life is reduced to its physical substratum. The reduction of the human being to a machine (and the practice of treating people like machines) corresponds to the same tendency. The idolatry of the machine leads to lost freedom, less and less choice, submissiveness as part of the new human condition, and obsolescence. Sustainability is abandoned for the sake of immediate satisfaction. Mediocrity undermines authentic value.

Would all this mean that museums and private collectors of early computer graphics images are wasting their money? Or that they are not important for understanding our own change? Of course not. They should be celebrated. One of my own pieces (*Free-form Constructions by Iteration*, Nadin 1966) made it into the Victoria and Albert Museum via the collection of the American Friends of the V&A through Patric Prince.



→ Fig. 4
Mihai Nadin, *Free Form Construction by Iteration*, 1966, print. Black, computer-generated drawing. The original print was lead on paper. Program written by IBM machine language and a Monte Carlo random number generator to generate a pseudo-free form drawing. The plotter was built by the artist. Original work: 25 by 32 cm. Donated to the V&A collection by the American Friend of the V&A, through the generosity of Patric Prince. (Leonardo, 24, 1991)

Anne and Michael Spalter are courageous collectors (who, when they started to collect computer graphics, were ridiculed by speculators in established art). The ZKM (the Center for Art and Media in Karlsruhe) is a serious repository of all kinds of digital artifacts. But the reification of the past should not lead to exacerbating the idolatry of the machine to the extent of doing away with ourselves.

Testimony from a Theoretician (Not Shy to Identify as Such)

In my record of accomplishments (I don't report on my own computer graphics here), there is the Frieder Nake show (*Die präzisen Vergnügen*) at the Kunsthalle Bremen (2005). It took place after I convinced Wolf Herzogenrath, the Museum's director at that time, that Nake's early prints of computer images deserved public attention. And again, a Nake retrospective at the ZKM (Peter Weibel gave in to my pressure; Nake was generous in acknowledging my help). But there are also failures: I could not convince MIT Press to publish an English translation of Nake's book, *Ästhetik als Informationsverarbeitung,* (Fig. 4). It still is, with its charming quotes from Mao's Red Book, and with its Bense/Moles cult blindspot, the most serious publication on the many aspects of the aesthetics of images generated using algorithmic methods. It should be published in English—probably with annotations from its author.

→ Fig. 5
Aesthetics as Information Processing.
Foundations and Applications
of Informatics in the field of
aesthetic production and criticism.
Springer-Verlag, Vienna/New York, 1974

Another miserable failure: I could not convince the Dallas Art Museum (i.e., Bonnie Pitman, the director at that time) to host Harold Cohen's *Aaron*—the very first attempt by an artist to integrate AI methods in making art. Even Manfred Mohr's art was not good enough for the Museum. Today, Cohen's works and those of Mohr appear in the international auction market. I failed when trying to organize a Sherban Epuré show (*Leonardo* was as helpful as possible). And I failed again, this time with Nake as co-host, in convincing the NSF and the NEA to fund a meeting of all those still alive who generated early images working with computers. My own university, with a program in art and technology—folded due to the incompetence of administrators exactly at a time when the program is more necessary than ever—was not interested. Worse yet: 158 million dollars will be spent to build an "Atheneum" (already nicknamed "Mausoleum") dedicated to mediocre collections of oriental art and someone's private library, while the idea of a repository of early digital music, images, and multimedia could not warm the heart of anyone among those running a capital campaign of $750 million. Imagine: instead of unsustainable museum space (the old obsession with brick and mortar), instead of useless collections dumped as gifts for tax urposes, a digital repository, open, via the Internet, to researchers around the world and to the public. Indeed, regardless of whether there is such a thing as computer art, the early investigations of computer graphics, of music, of interactive installations are testimony to humankind's dedication to the new. And it should be available in its digital reality, not as a collection of prints. The fact that some of these investigations ended up in extremely useful visualization technology—think medicine, from the pre-computer Roentgen (X-ray machine) to the

digital "X" rays and MRI—and others extremely harmful—the technology of brute-force wars—is only one aspect. These investigations affected our ways of thinking, and they affect human condition in the age of networking. Without computer graphics, the Web would not exist.

Is being tethered to one's cell phone (yet another offspring of computer graphics!) progress is as much an open question as whether our notion of art changed, and whether the notion of chess playing irreversibly changed. Of course, I was, and still am, hoping for more of the good, even during a time when the evil seems to have the upper hand. Therefore, I cannot second my friend's call: "...no more computer art." Rather: understanding the need for a new perspective might help in making our own choices, which art exemplifies as a meaningful living process that cannot be reduced to data processing. Even today, we look at life through the "eyeglasses" of physics. It is time to reverse this. Understanding life and art, in particular, as expression of meaning, might be the key to understanding the broader reality.

I wish I could express this idea in a work of art. But I am only (and happily) a mere theoretician who was lucky enough to live through the most exciting time ever.

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