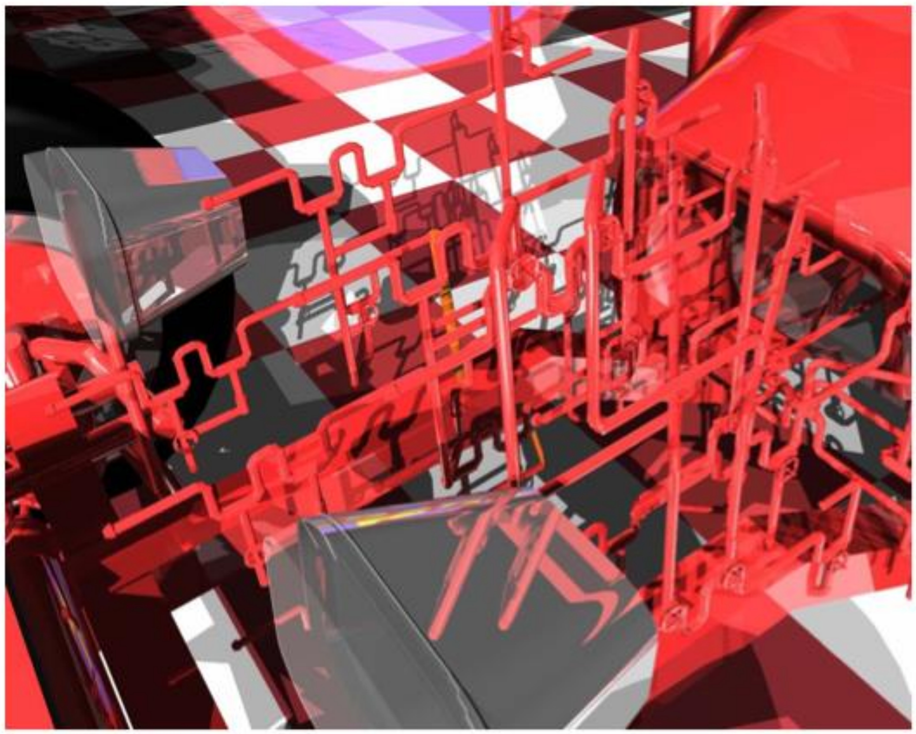
The New Artist's Computer

By Fred Truck



The Artist's Computer

What is an artist's computer?

Aside from a platform for artistic activity (that you could buy from Apple or IBM), let's begin with a standard definition of a computer. Margaret Rouse, editor of Technopedia, defines a computer as this:

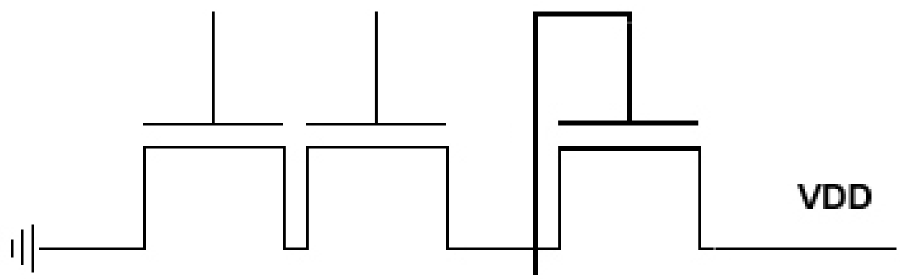
A computer is **a machine or device that performs processes, calculations and operations based on instructions provided by a software or hardware program**. It has the ability to accept data (input), process it, and then produce outputs.

My definition of an artist's computer differs from the definition given above in that the output of the machine is the machine. This is possible because the input given to an artist's computer is also the machine. An artist's computer is a complete expression of recursion.

In mythical terms, an artist's computer is an ouroboros, the snake devouring itself.

In 1986, I began ArtEngine, a piece of software for the Macintosh computer. The user submitted two previously edited images to the Engine and from them, it generated a new, third image. I wrote this software, which incorporated some artificial intelligence techniques, in MacScheme, a compact rendering of the Scheme dialect of LISP, the staple language of articificial intelligence programming.

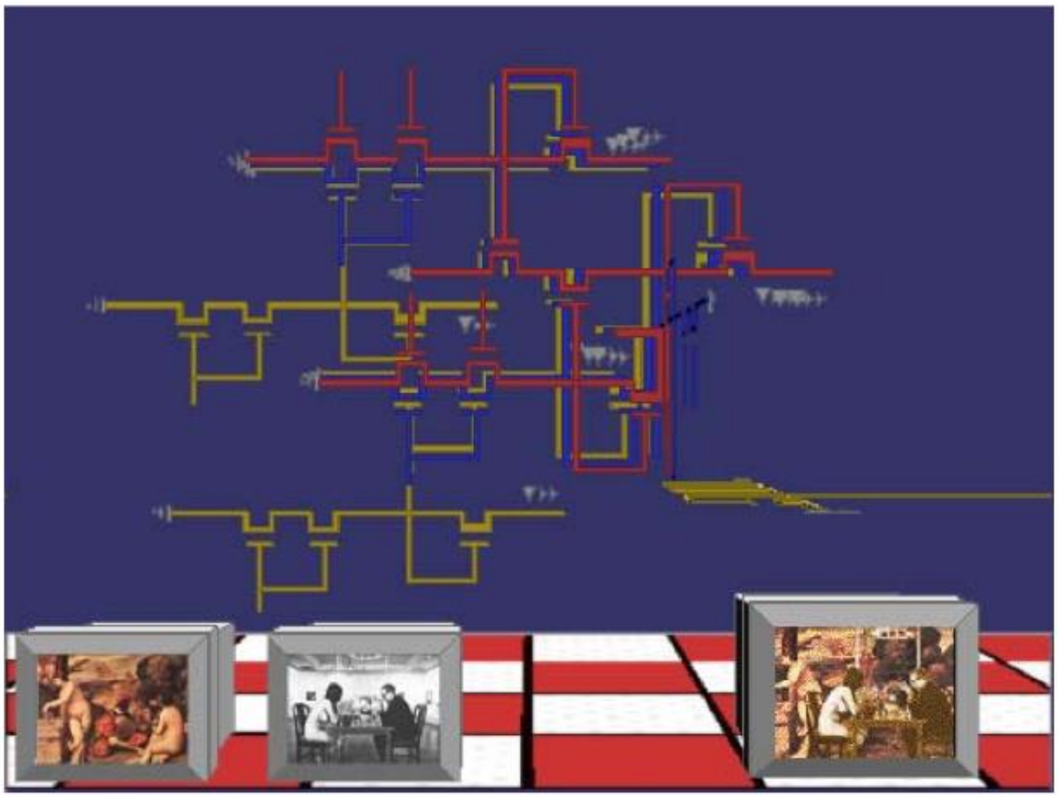
In 1991, the Macintosh no longer supported some of the conventions and techniques Macscheme used, and ArtEngine found itself without a platform. I was reluctant to walk away from five years of work with an idea I found intriguing. As I thought over possible directions to go in, I remembered an interesting fact about LISP. LISP is rich in symbolic logic functions. A symbolic logic function, or BOOLEAN function is any of these logical functions: AND, OR, NAND (Not AND), NOR (Not OR). Because it encourages the programmer to define new functions by combinations of the given ones, LISP is particularly useful for simulating logic chips, before they are committed to silicon. I also learned that all the logical functions can be generated by various combinations of the NAND gate. At the same time I remembered this, I ran across a diagram for a NAND gate:



The NAND gate is made up of 3 transistors, two input transistors and one output transistor. In the diagram above, the heavier line is the output transistor. I was excited with by the wave-like appearance of the NAND gate. I wondered what the central routine of ArtEngine would look like if I visualized its logic.

The central logic routine of ArtEngine determines that two things have been put to it, and that one input is symbolically true and one is symbolically false. That is, the two inputs are different. After difference is determined, the Engine approves the generation of a synthetic third image from them using other software or hardware following the Engine module in the information flow.

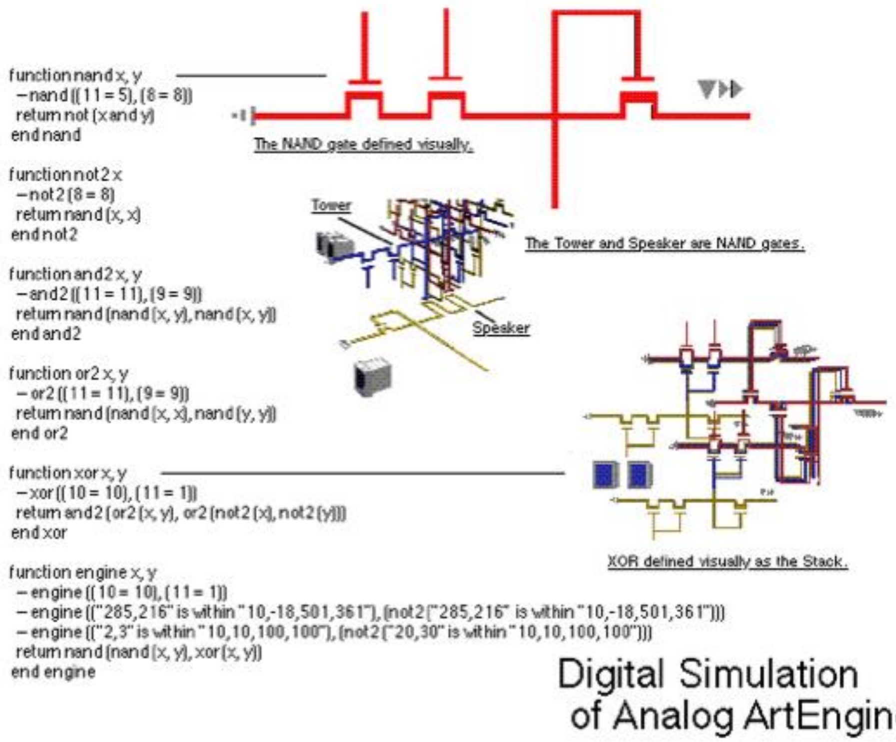
My first realization of Analog Engine, the visualization of my ArtEngine software, was done in CAD/CAM software. This usage proved to be very important and troublesome later on. It used the steam pistons described previously. Because I viewed these images as maps or diagrams of circuitry, I even duplicated the 3 vertical lines of the ground symbol and the VDD at the other end of the diagram in my 3-dimensional renderings of the gate.



As you can see here, Analog Engine floats in CAD/CAM space, without gravity. In the foreground are three monitors revealing the Engine's process.
A. Concert Champetre by Titian or Giorgione
B. Photograph of Marcel Duchamp and Eve Babitz by Julian Wasser

C. Synthesized image
In addition to the shape of the NAND gate, the Engine's format was determined by the programming conventions shown in the following

image. For this picture, I used the HyperCard scripting language, rather than Scheme, because at the time, that language was accessible to more people, and its conventions were very similar to Scheme. Notice that there are layers that are color coded, and that everything is generated from the NAND gate. Note that in the following programming, lines preceded by “—“ are comments, and are not evaluated by the interpreter.



From approximately 1995 until 2000, I did very little work on the Engine. I used it as a motif in a number of prints, so it was never very far out of mind. I realized at some point during this time that the Engine had the potential to be a sculpture, but two conceptual problems needed to be solved in order for a sculpture to be built, in addition to finding a material suitable for executing the work. The problems were:

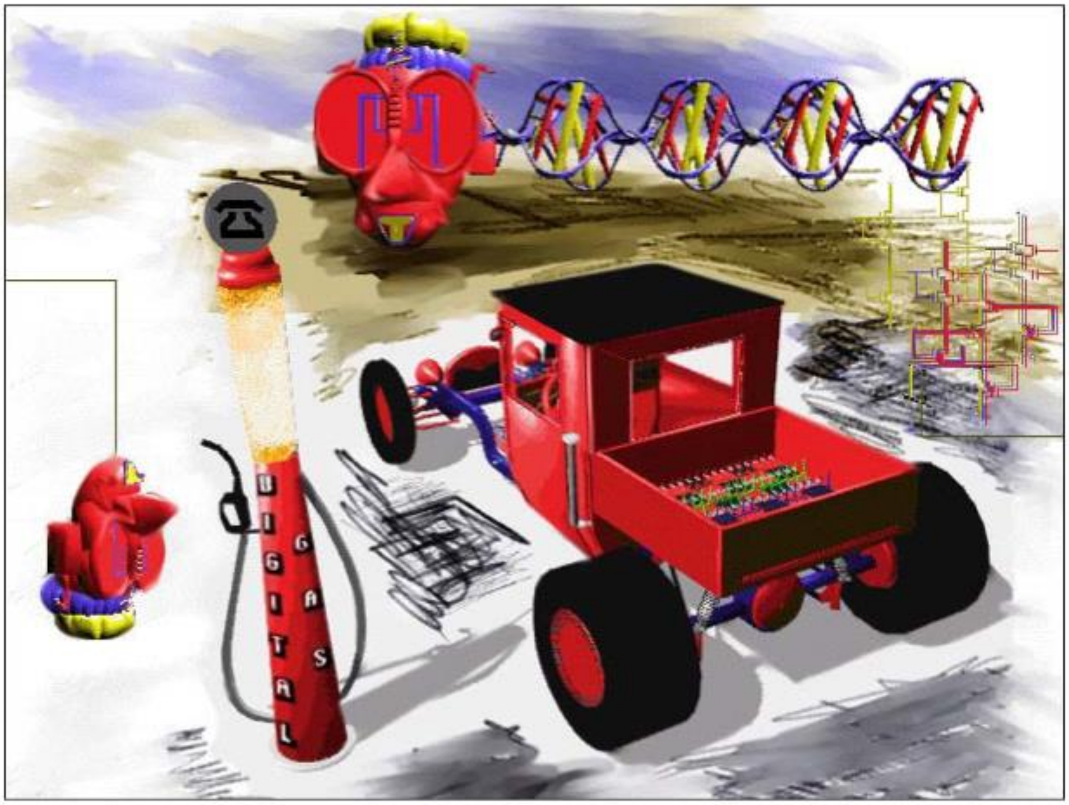
1. Often, one color-coded layer would feed another. That is, the output of one layer served as input for the next layer. As long as I was working in CAD/CAM space or animation, I could have those connections be hypothetical, or I could indicate them by simultaneous movement. I feared diagonals might disrupt the grid structure.
2. How would an Analog Engine sculpture stand? Suspend it from the ceiling? Support it from a rear wall? Could it stand on the floor somehow by itself?

While I put these issues in the back of my mind for analysis and digestion, I did a series of prints suggesting issues of interest and directions for the future that are still not, as of this writing (2023), fully realized.

Digital Gas and Mobile Computing

The first computer I bought was an Osborne I portable microcomputer. It had a tiny 5.5" diagonal screen, two disk drives, 64K of RAM and weighed about 35 pounds, thus making it marginally portable. Compared to the laptops or palm computers of today (2002), it was absurdly clunky but it keyed on a basic need most Americans have: the need to get up and go and to take whatever they want with them.

This perception led to a series of prints called Digital Gas. The first print has the same name as the series.



The Red Truck in this image appears frequently in my work. The Red Truck is a hot rod based on a 1929 Ford Closed Cab Pickup Truck. The Memory Device is in the bed of the rod, which is powered by Analog Engine, though in this image, that fact is not visible. Next to the Red Truck is an antique gas pump. Though the pump is labeled as "Digital Gas," at the top is a telephone symbol, where an oil company logo usually appears. The Red Truck is fueled here, not by steam as Analog Engine is, or gasoline as a car would be, but by telecommunications. Information.

The Mayan Sun God is a frame for the image. The Sun God is derived from classic Mayan sun god imagery, with some differences. Where the classic god has a sky band body, my Sun God's body is made up of a double helix of DNA, with Analog Engine making up another segment.

The Sun God is information of another sort. It is information that takes two different things and makes a new third thing out of them.

Drive is a straightforward depiction of information on the move.

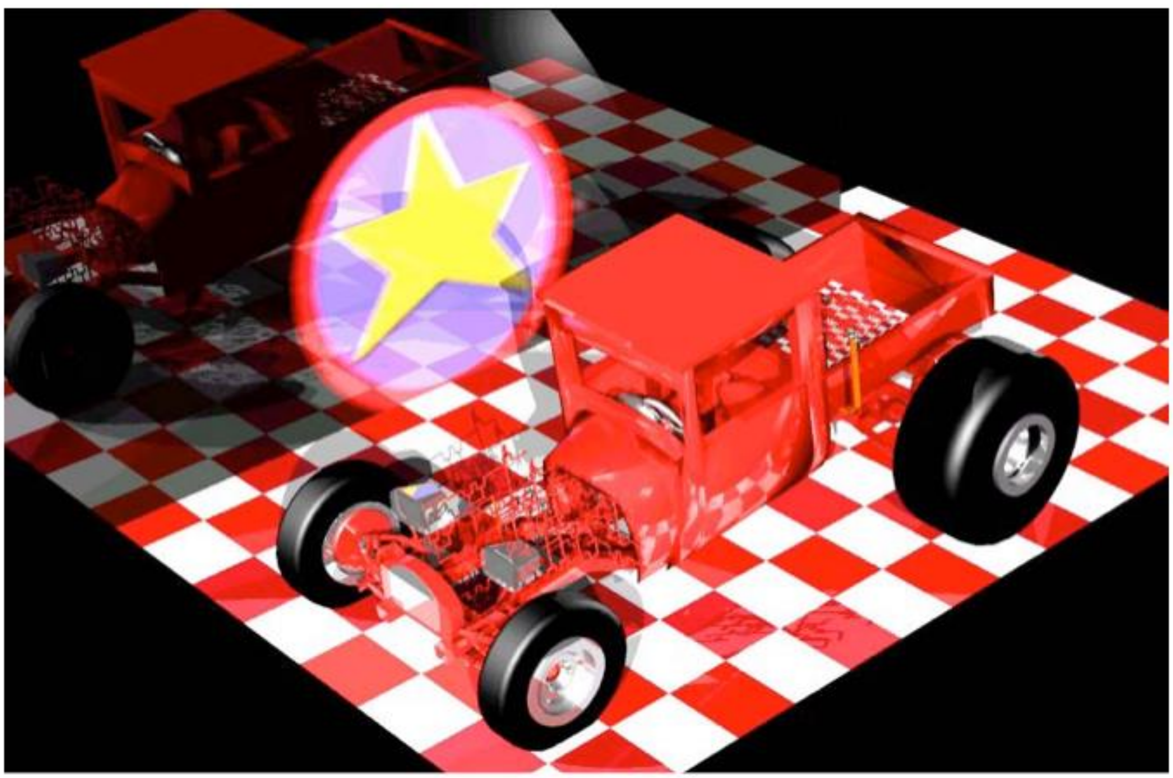
The last image in the Digital Gas series is called American Home. Featuring the Red Truck, the Mayan Sun God and the Digital Gas pump from the series title image, it also shows my house at the time.

Many people do most, if not all, of their work with computers at home.

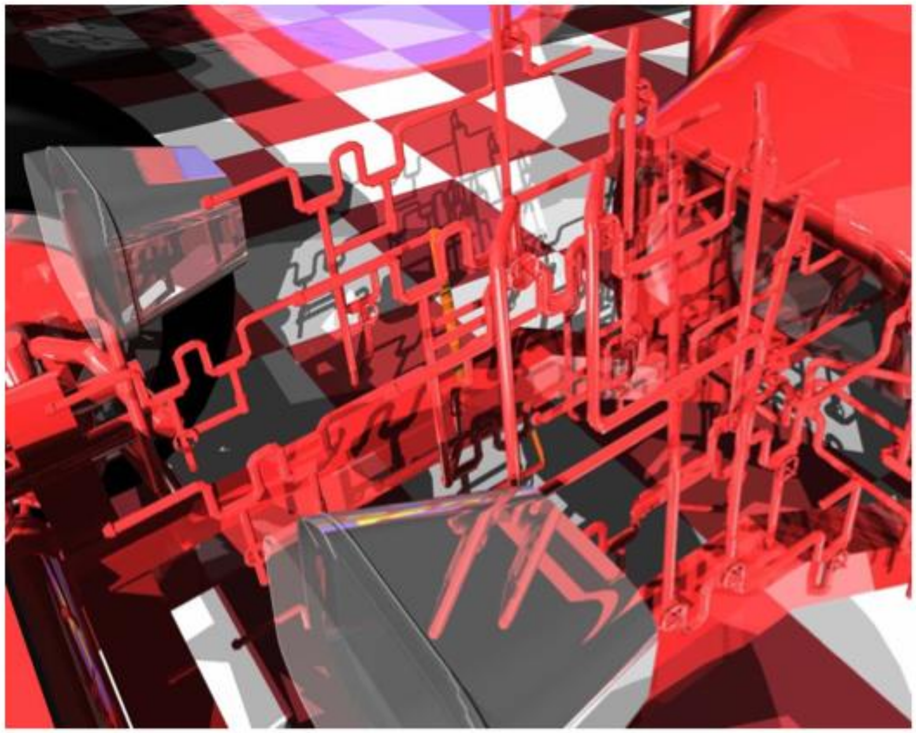
While pursuing these visualizations of Analog Engine and mobile computing, I was busy engaged with other projects. One of these took me to one of the hardware superstores in my area. I needed some PVC plumbing parts. I took one look at the amazing array of parts available to me at a very reasonable price, and realized that by making some small changes in the Engine’s design, it might be possible to build a sculpture out of PVC. In particular, a PVC Stop and Waste valve was very interesting to me.

In March of 2000, I got a new computer with new CAD/CAM software. This prompted me, over the next 9 months, to do a new version of the Red Truck, as well as a new version of the Engine.

While the Red Truck remained substantially the same, Analog Engine now featured hand wheels and valves rather than pistons. Part of the reason I did this was that very early computers did not have transistors, but assemblies of vacuum tubes. Switches were called valves and were set by hand. The other reason I used hand wheels of course was I had begun to think seriously about using PVC for a sculpture and I wanted to see how stop and waste valves would look.



This print is called Rollout. The Badge of Quality, a fictional corporation that is a frequent subject of my work, is rolling out the first production version of their retro hot rod, the Red Truck. A checkerboard floor, both on the ground and in the bed of the truck, is prominently featured. Analog Engine drives the truck, and the Memory Device is in the bed.



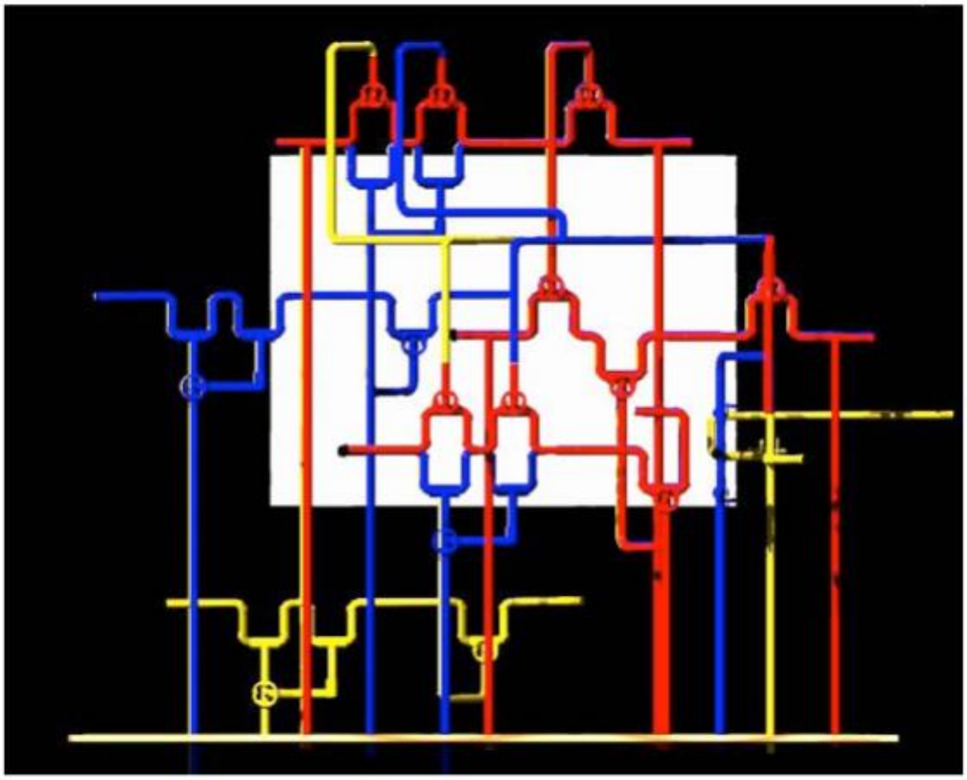
This image is called Engine Abstraction, and is a close up view of Analog Engine in the Red Truck. The hand wheels can be seen more clearly, and also, in the right center area one can see diagonal connections allowing the output of one layer to feed the next layer. This version of the Engine is monochrome, in keeping with the monochrome styling of the hot rod.

Considering Rollout and Engine Abstraction, issues of representation and abstraction cannot be avoided. Analog Engine itself *is* an abstraction of symbolic logic functions, but it is also a very physical realization. When it is placed in the Red Truck, which is more clearly representational, it blends seamlessly into the environment, but when the Engine is focused on by itself, in a manner similar to a camera highlighting the weave of a carpet, as Andreas Gursky has done, its abstract qualities are obvious.

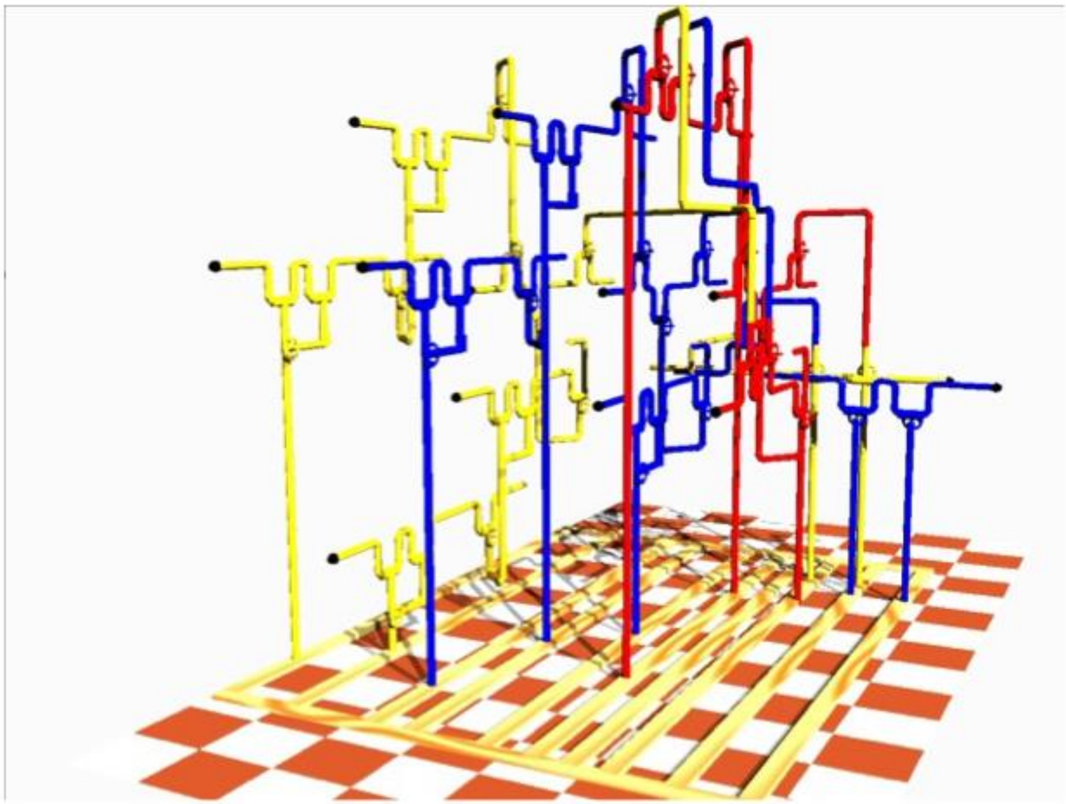
The Sculpture

This version of the Engine is the same one as is in the Red Truck, complete with hand wheel set valves, but here a solution to the support for a sculpture is being explored. The colored layers have returned, and the diagonal feeds are clearly visible. The back wall is a mirror, and hidden pipes extending from it support the sculpture. The checkerboard floor also plays some role in support.

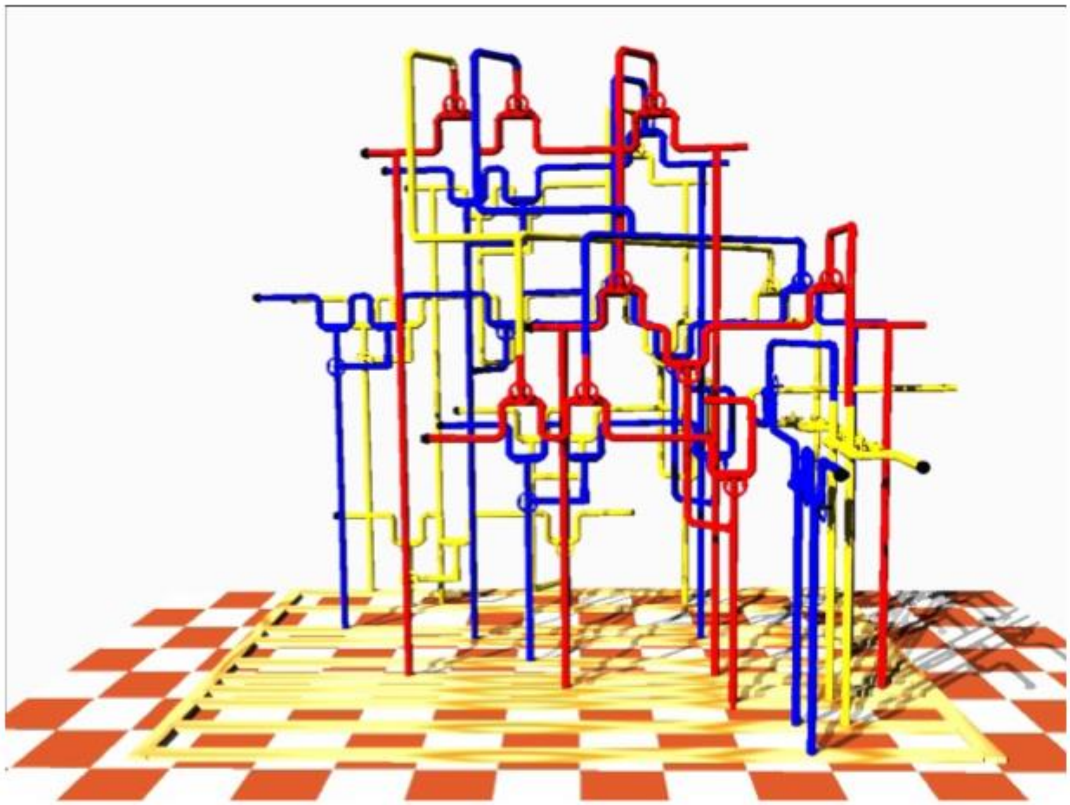
I became dissatisfied with the back-wall-support idea. From rotating the Engine around andaround in CAD/CAM space, I came to the conclusion that the back was as interesting as the front, so I began thinking about making the Engine self-supporting.



Isometric Projection View



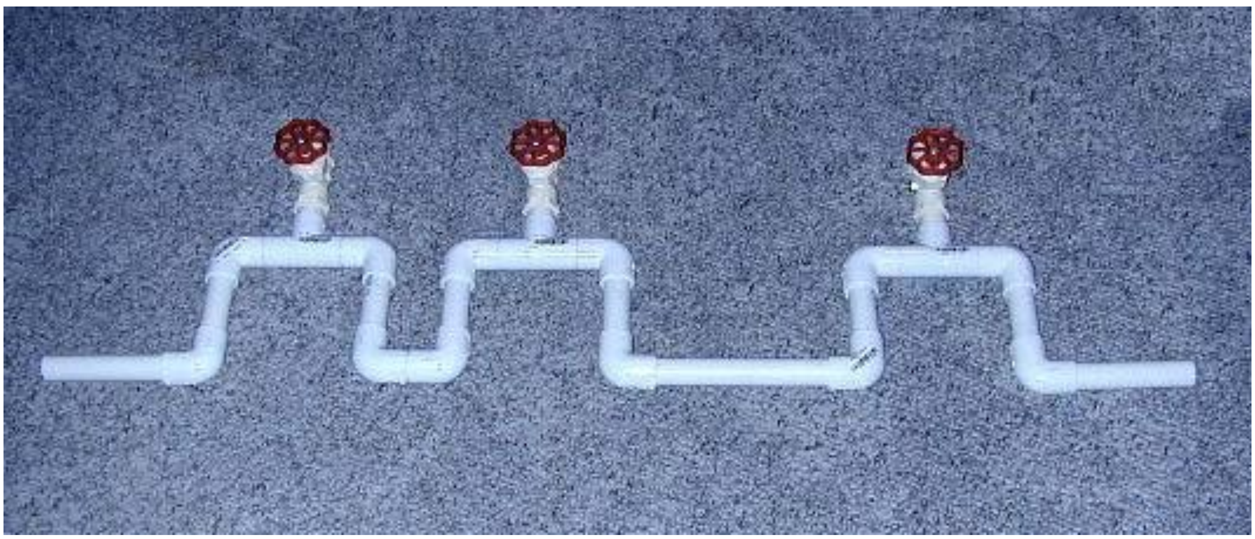
Counter-clockwise Rotation



Front View in Perspective

These three images show the base design I came up with that I thought would make the Engine stand on its own. I extended some input pipes to the floor, reasoning hypothetically that the steam source would be hidden the next story down. I added a few additional vertical braces, which I colored the same as the layer they supported. The problem with PVC pipe, as anyone knows who has worked with it, is that though it appears to be rigid, it actually has quite a bit of flex in it, as any pipe made for conducting water does. This means that any structure built from PVC pipe will not support its own weight without flexing. I thought that if I made a wood frame from 2x4 pine, and accurately measured where I wanted the vertical supports to be, I could drill holes in the pine, which would then brace the PVC against its tendency to flex.

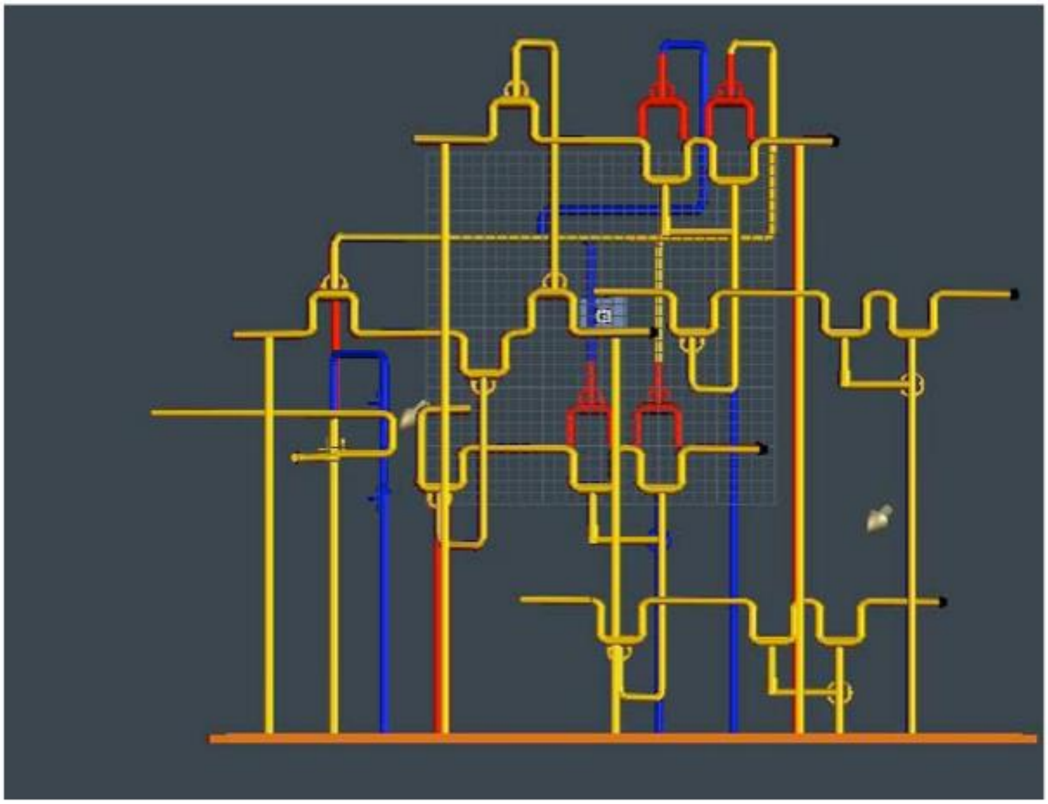
I finished these designs in August of 2000, and then thought about them for almost two years. During that time, I built some test “gates.” Their construction was routine. But painting them turned out to be difficult. Basically, the only thing that will stick to PVC is PVC-based paint. I had envisioned all kinds of pearlescent finishes, but it was not too be. Later, I did some research and discovered that latex paint adheres well, but it can’t be acrylic latex. It has to be latex, period. I found some glossy latex paint that was fabulously laden with pigment, and tested it. It worked quite well.



A test gate

On July 5, 2002, I began building the sculpture. I still did not know exactly how my base would work, but I knew it would not be made of wood with holes drilled in it.

I began with the back layer of the machine, the yellow layer.



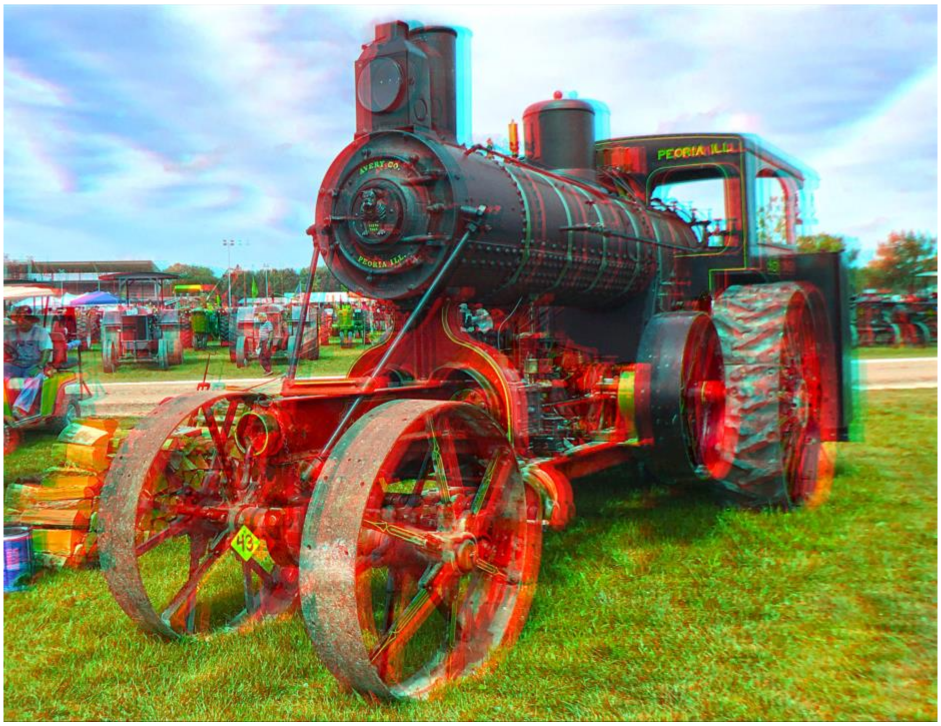
Isometric Projection from rear of Analog Engine

I decided I would make everything from PVC. Using the rear isometric projection as a guide, I built the yellow layer and found it would not stand on its own, so I kept adding braces and

supports until it did. I then connected the vertical supports with an ad hoc rectangle, doing whatever I needed to do to make the layer stand.

The results were amusing. The verticals still bowed, and sometimes the horizontal gates sagged.

I also found through the process of moving the layer from my basement to my living room to my dining room to the back yard, which required disassembly and assembly frequently, that no matter what I did, I could never force the PVC to go back together again the way it had been before. PVC seems to breathe, and how level the floor was that I put it on affected it greatly. Nevertheless, I found this quality pleasing.



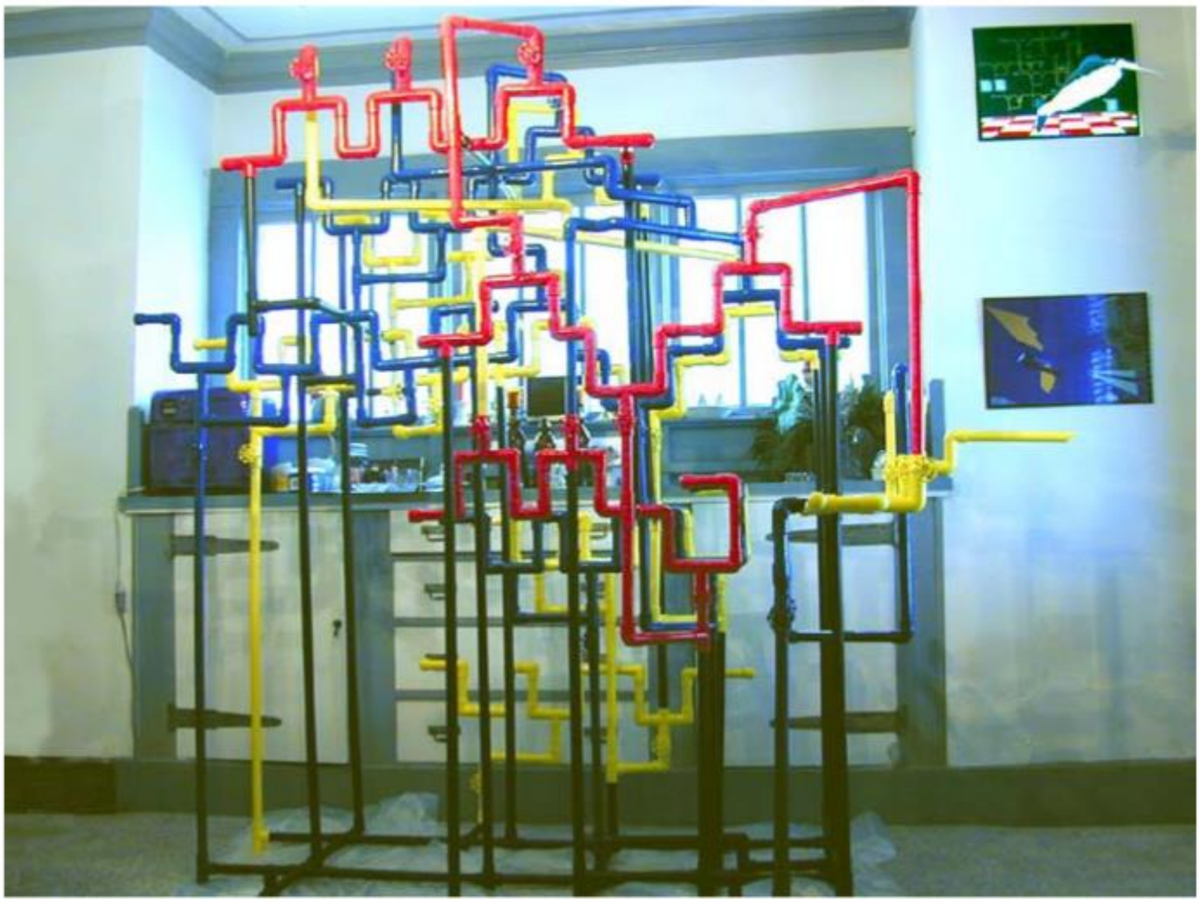
I grew up in Mt. Pleasant, Iowa, a small rural community in southeastern Iowa. One of the seemingly few advantages of growing up there was that I was exposed at an early age to antique steam traction engines used on farms from the late 19th century up until World War II for threshing. In Mt. Pleasant, every fall, there was a huge festival celebrating these machines and the people who worked them called The Midwest Old Settlers and Threshers Reunion. From its inception, when it was mainly a gathering of a few wealthy farmers with some time on their hands after harvest who loved these old machines and saw it as an occasion to bring their families together to have some fun, to when I left Mt. Pleasant, and the Reunion featured hundreds of steam engines and drew thousands of people from all over the world, I have been fascinated by these roaring hot, hissing giants and their incredible power.

As a child, playing on the Avery Undermount Steam Tractor, I learned firsthand that nothing on those machines was straight. Practically everything was handmade and aligned by eye. Peering through the cab window, down past the long barrel of the high-mounted boiler, I could see the pipes running along it were bent and distorted by heat and accident, the usual stuff of daily work. These memories came back to me in force as I considered where to lay the next brace on my wobbly yellow layer.

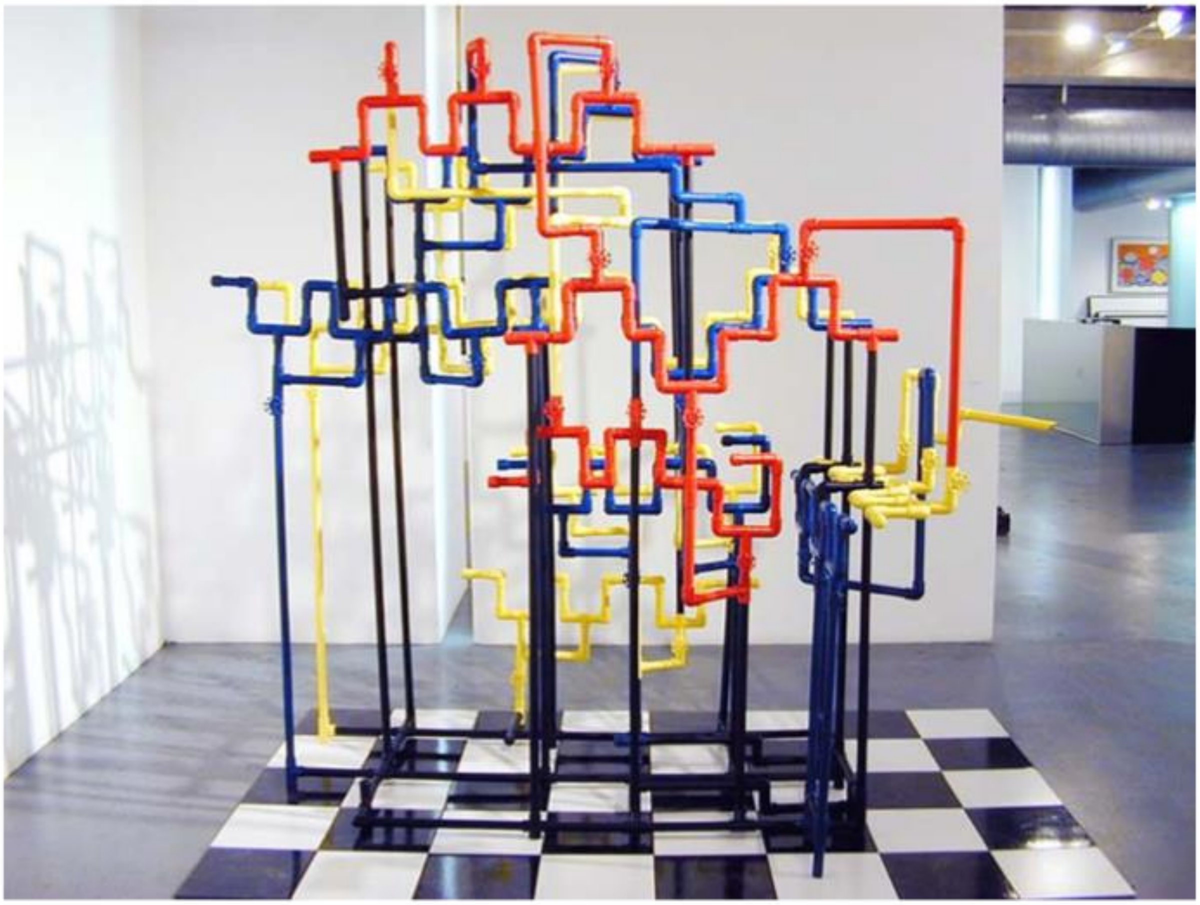
I planned, early on in the construction, to distinguish vertical and horizontal supports from vertical input pipes by painting the supports flat black, as well as the rest of the support structure. The input pipes bore the same color as they layer they fed. This decision continued my basic color code design and made it possible to trace a path steam traveled for almost anyone.

Analog Engine, Unpainted

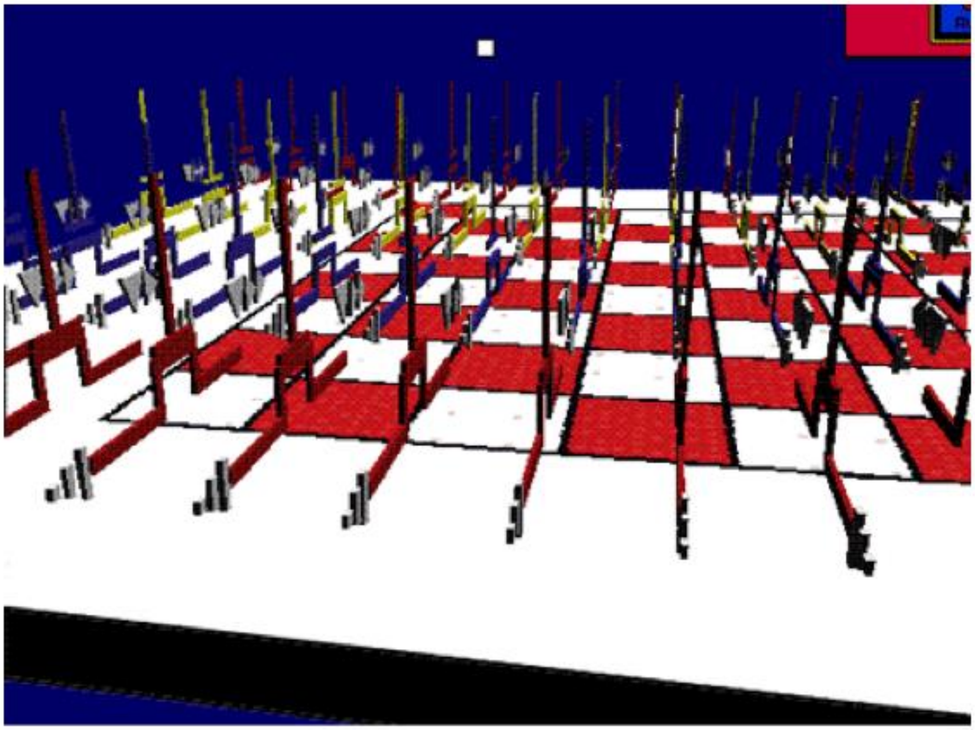
Overleaf: Analog Engine Painted, In the Dining Room



Everyone should have an Analog Engine around the house, don't you think?

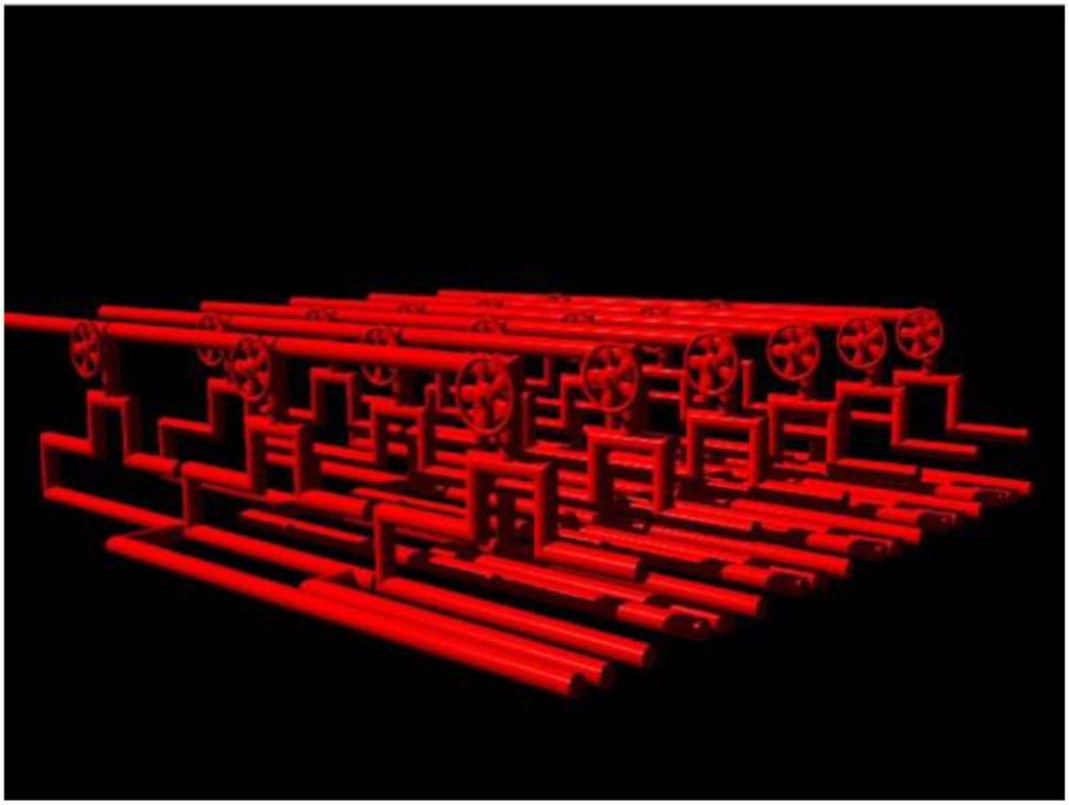


Analog Engine is 83x97x44 inches resting on a base that is 60x96 inches. The sculpture is made of PVC and gloss latex paint. The base is ceramic tile. Installation view at Karolyn Sherwood Gallery (formerly Steven Vail Galleries), November, 2002 through January 2003.

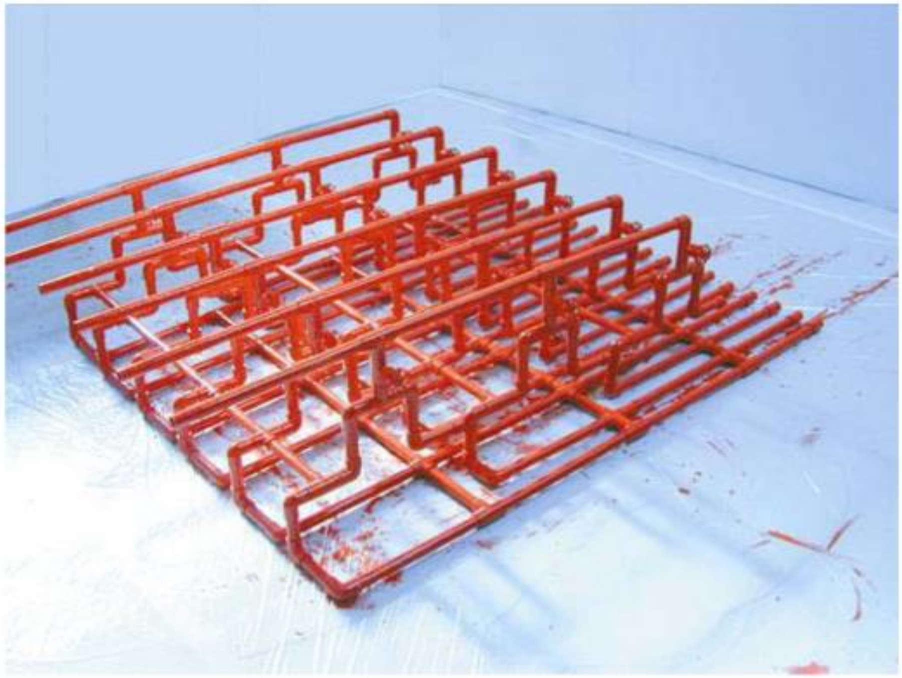


The Memory Device

This image shows the Memory Device in its very early stages of development. It consists of 72 switches. Another design stage followed:

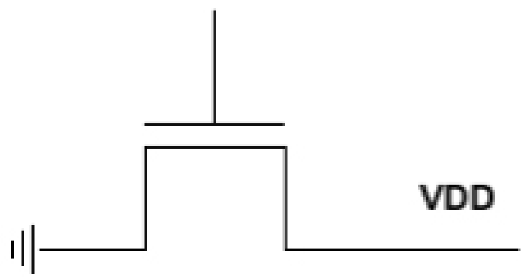


In this stage, the Memory Device consisted of 18 switches. Here, for the first time, hand wheels to set the switches appear, and input and output are differentiated. Six inputs (coming from the rear of the device) result in 18 different outputs.



This is the final form of the Memory Device. My sculpture is approximately 6 feet square and 18 inches high. It is made of PVC and painted in gloss latex. It differs primarily from the preceding design in the manner in which the outputs are routed.

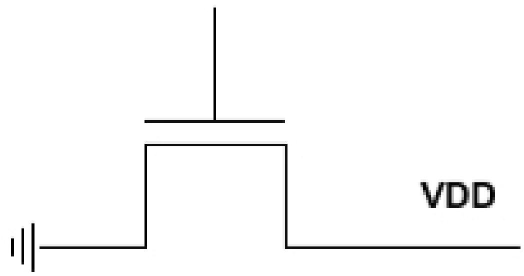
All three stages of design are composed of an array of on/off switches or transistors, represented by this type of diagram, often used in electronic engineering:

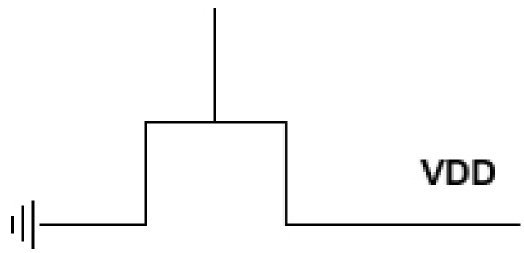


This on/off switch is a transistor. What interests me here is not how transistors actually work, but what they look like in this picture, and what kind of associations their appearance may lead me to.

Having said that, it is still important to understand that this switch has an ON state and an OFF state and that, in actual transistors though no part actually moves, the language USED to
describe transistors implies movement. That is, the switch is referred to as a gate and when in the ON state, the gate is said to be OPEN, and when in the OFF state, the gate is CLOSED.

The "open" and "closed" language used in describing gates led me to imagine pistons:





Exit

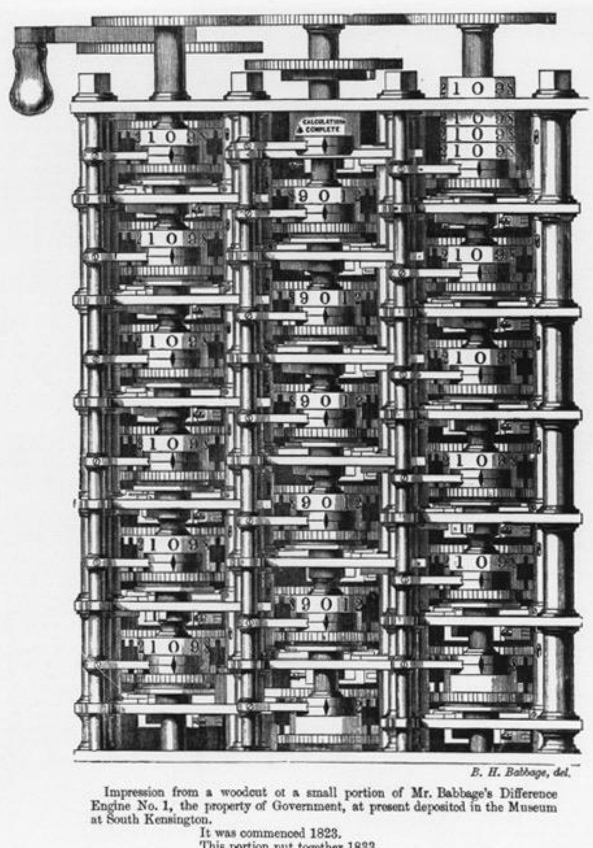
I imagined these gates to be powered by steam, with an actual piston making its on and off states. My early designs for the Memory Device used just such steam-powered pistons.

Why steam? Why not electricity or at least gasoline?
Well, there is history to consider. There is a historical precedent for steam-powered computers.

Charles Babbage

Charles Babbage, an English mathematician and inventor, was born in 1798. He invented the Difference Engine, a steam-driven calculator, in 1821. He later developed the Analytical Engine, an improvement on the Difference Engine, which was designed to solve any kind of mathematical problem. The Analytical Engine received instructions on punched cards, performed its calculations, and printed them out. This description sounds much like a description of early mainframe computers. Due to his frequent changes in design and the lack of precision machining necessary to build the machines he designed, and the lack of support of the British government, Babbage was never able to complete his Analytical Engine. However, using Babbage's designs for the Difference Engine, George Scheutz, a printer from Sweden, built practical versions of that machine in 1854, which were used by both the British and American governments.

Charles Babbage appeals to me not only because he was far ahead of his time, but because he was able to order a number of available technologies of his time—steam, mechanical technology and design—towards the solution of a vexing problem. The specific problem that irritated Babbage so was that human computers made too many errors in figuring logarithmic tables. He reasoned that a steam-powered mechanical calculator would not only eliminate human error, it would be faster. He was also a visionary who foresaw that it might be possible for a mechanical calculator to work in the realms of symbolic logic.



B. H. Babbage, del.

Impression from a woodcut ot a small portion of Mr. Babbage's Difference Engine No. 1, the property of Government, at present deposited in the Museum at South Kensington.

It was commenced 1823.
This portion put together 1833.
The construction abandoned 1842.
This plate was printed June, 1853.
This portion was in the Exhibition 1862.

As an artist, using steam as a power source enabled me to solve the problem of scale. Contemporary digital computers are marvels of nanotechnology, but working on a microscopic scale is not the most direct way to create a powerful visual impression. Translating the visual patterns of the designs for electronic circuitry from electron power to steam power enabled me to build the circuits as large as I wanted.

Displaying Analog Engine and the Memory Device

At this writing, Analog Engine has had a gallery showing, but the Memory Device has not. If they were ever to be displayed simultaneously in the same gallery, the Engine should be by itself in one room, and the Memory Device should be by itself in another, adjoining room. They are parts of an as yet unstated whole. Within themselves, they give no indication of what their relationships to the whole may be or what their relationship to each other is. Even the original ArtEngine software I wrote does not contain a clue, because there is no section of the software called the Memory Device. There is an Engine, but no Memory Device.

The reason this is the case is because Analog Engine is an analog computer and the Memory Device is an array of switches. A digital computer is a device that can receive many different kinds of instructions in the form of software and can execute all of them. It is as close as we have to a universal machine. An analog computer is hardwired software. It is both the instructions and the executor of those instructions so it is by definition and in practice, a single task computer.

So far, the Memory Device has been described only as an array of 18 switches. Why not 24 or 108 switches?

When I was in high school and just beginning to wrestle with art issues, a perceptive teacher told me to pay attention to my dreams. I did this for a number of years. By the time I was at the end of my college career, I found that I did not have many repeating dreams, but I did have many repeating images.

Over the next few years, I tracked those images. In 1974, I finally formalized these images in a language of 18 images, including the caduceus, the ouroboros (snake devouring itself), a bowl of water, the sun, twin girls, games and others. This language has changed somewhat over the years, but its essence has remained the same. One other element, a feature of all my most intense dreams, was an extremely clear sense of perspectival space; that is, my most powerful dreams all seem to be enacted in a rationalized space.

At this time in my artistic practice, I no longer arrange this language by chance or a grammar, as I did when I began using it, because it comes from so deep within me that it is always a part of my work, intentionally or not. When I externalized my creative process in the form of the Memory Device, I hard-wired it, because it was the best way to make my process quantifiable. The Memory Device keeps track of these 18 dream images. It is a checklist that feeds Analog Engine a record of which of the 18 dream images is present in the images under consideration. Then, Analog Engine processes this information and completes the work.

The CPU

When the Apple II was released in 1977, it wasn't long before the company asked for artists to submit ideas to be developed on their machine.

I suspect that not many artists responded because at that time, most were still committed to the losing cause of the War against the Machines.

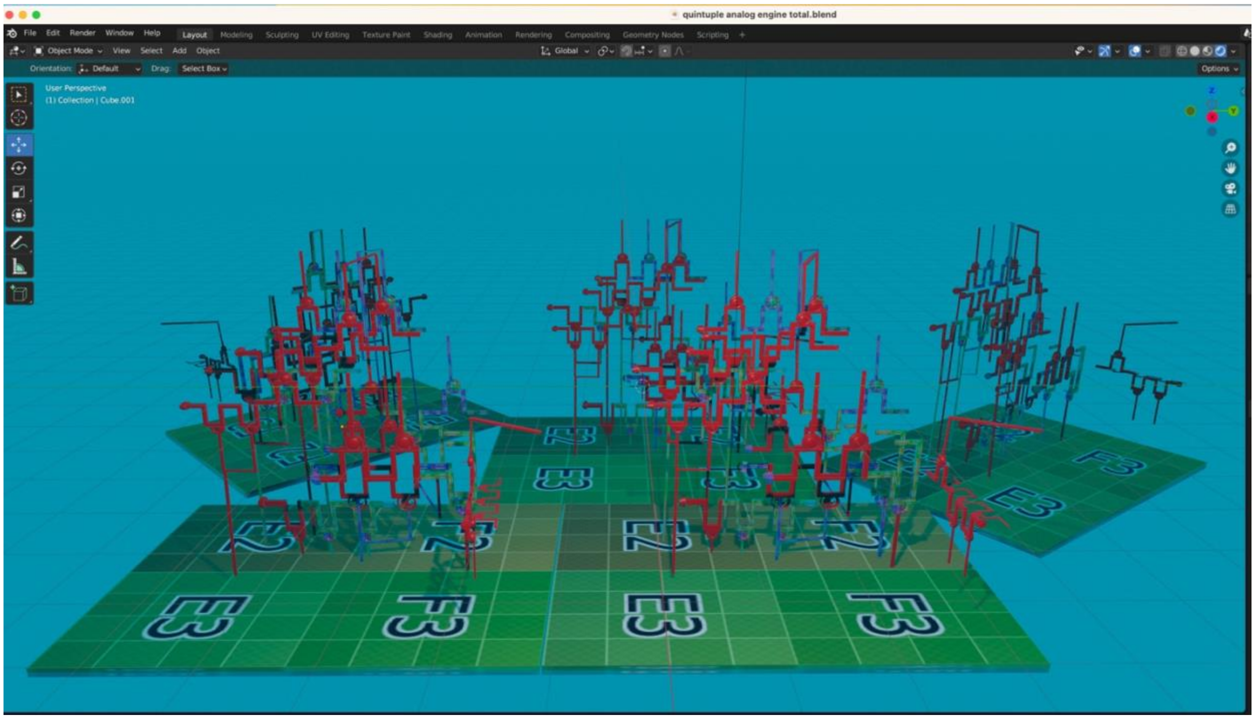
Eventually Apple's requests faded away.

I suspect an even deeper reason for the lack of enthusiasm for doing a computer- based work of art was that no one had any idea how to do one. Arts education typically didn't include sections on digital technology at that time.

It has always been different in the film and television segments of art school because these categories are technology-based. But still…

This is the reason I've written about and built the Artist's Computer. I began working on this project in 1986. I'm just now in 2023 reworking this essay, but the concept overall is still unfinished. There's more to do.

Realizing a work of art requires more than a single Analog Engine. Ideally, there should be enough XOR circuits to work on more than one thing at a time. This is why the artist's computer I am describing has a CPU. It is made up of many XOR circuits, though the number you actually see here, is just a suggestion of what is possible.



This 3D model is an image of an XOR CPU. It consists of 5 Analog Engines slotted into each other. Many connections have been eliminated for clarity. I did this 3D model in Blender, a popular CAD/CAM software package that is free, and very powerful.

The XOR circuits are using the silicon bases as sculptural supports in this model. In reality, if I had this chip made, you would not see the circuits standing up like this. They would be on the surface of the chip, flat.

The bases represent the color choices I made in Blender to shade the 3 main paths in each XOR circuit. The colors are coded in hexadecimal fashion, as F3 or E3, so the chips are color chips, in addition to computer chips.

[brief animation]

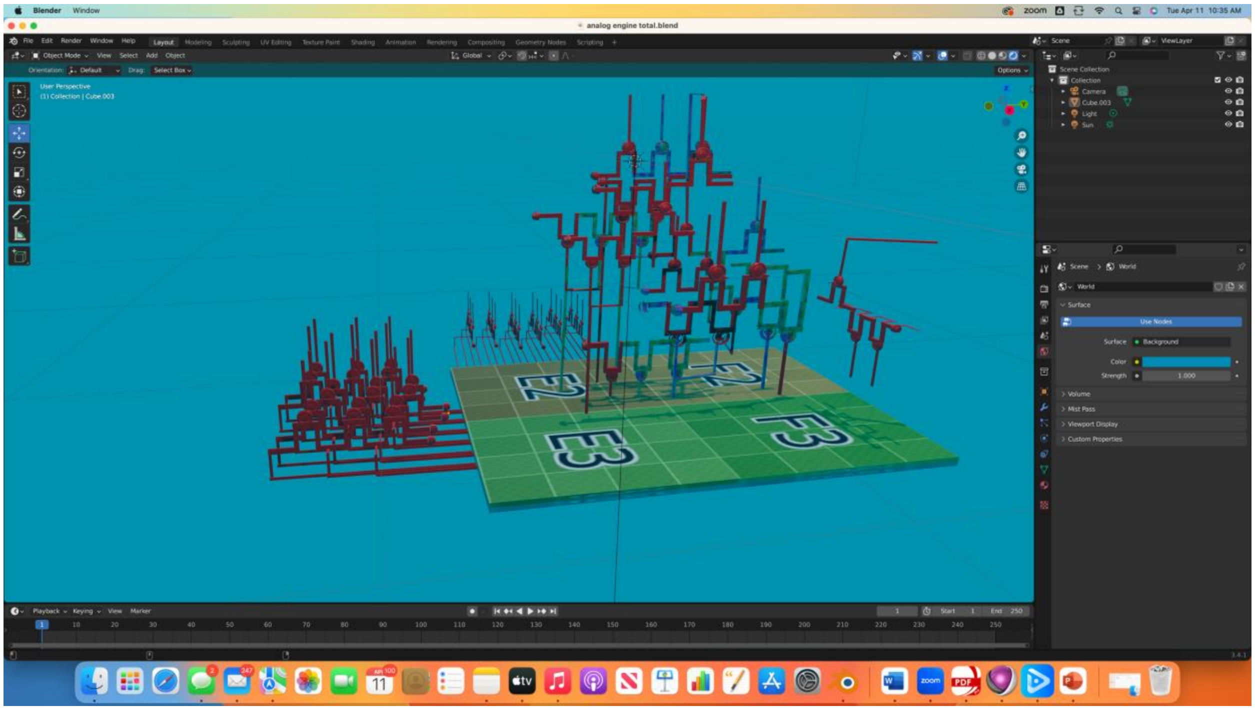
Memory Device Reconsidered

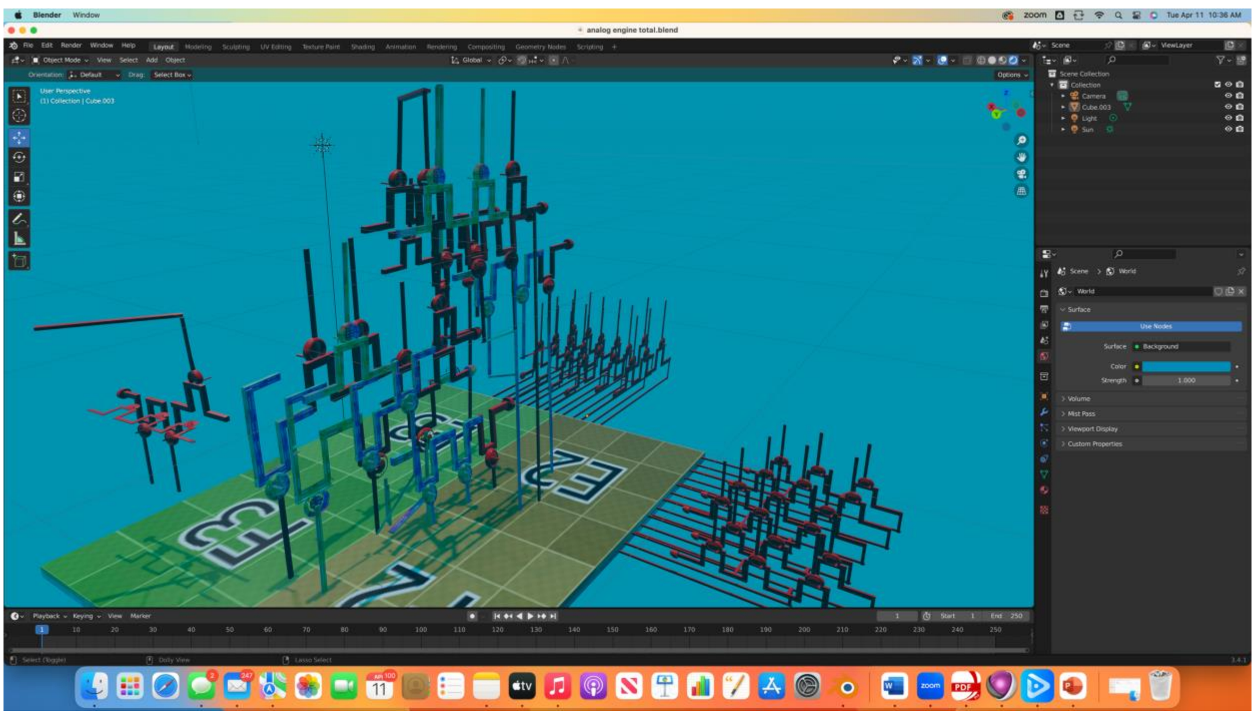
Finally, no matter how many Analog Engines can be strung together, the artist concerned will have a brain-dead machine unless there is some kind of memory.

I had already begun working on this problem. As I said above:

Over the next few years, I tracked those images. In 1974, I finally formalized these images in a language of 18 images, including the caduceus, the ouroboros (snake devouring itself), a bowl of water, the sun, twin girls, games and others. This language has changed somewhat over the years, but its essence has remained the same. One other element, a feature of all my most intense dreams, was an extremely clear sense of perspectival space; that is, my most powerful dreams all seem to be enacted in a rationalized *space.*

In the last few weeks, I reconsidered all my designs for a memory device, and made a few basic changes in the layout of the design, but no changes in its function. Essentially, the Memory Device now plugs directly into the Analog Engine. Here are a couple of screenshots of the Device. It still colors all output with the 18 values I tracked from my dreams.





The Analog Engine is now supported by 2 Memory Devices, one of which is larger than the other. The larger one recalls events immediately, while the other reflects vague memories, events recalled in the haze of waking up.

Also please notice that the handwheels are retained for setting the T or F dynamics of the output, even though such devices are not needed. The handwheels recall a more mechanical access to the mind of the artist, and also retain the history of early computing in which switches were set by hand.

“We are such stuff as dreams are made on…..”

That stuff includes computing machines.