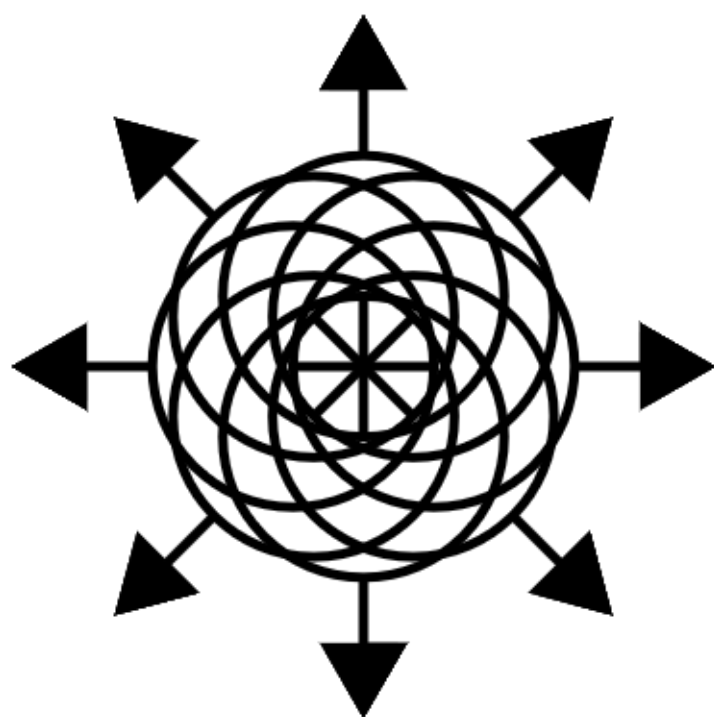


GEOMETRON



MAGIC

by Trash Robot

Geometron Magic

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Chapter 1

Magic

HOME

1.1 MAGIC

Our aim is to share technology which makes all of the elements of a good life free for all people everywhere. The technology we need to do this exists. From cheap local renewable energy to dense growth of food to safe disposal of waste, we have all the material elements of a life of plenty created by our shared knowledge. And yet we live lives constantly hounded by scarcity based on activities which are in the process of killing us all. Why? What is missing from our collective lives? This work is an attempt to answer these questions and to provide a path forward using new ways of engaging with existing

technology to build the social structures needed to get from a path of destruction and scarcity to one of creation and plenty.

Our current model of how we think of technology and “the economy” is based on production and consumption. In the modern world, material is extracted from the Earth, is processed into “products”, which eventually turn into waste, and then the process repeats. This process will always produce scarcity, as everyone must compete for the limited resources. That scarcity is managed by people claiming ownership over the land from which resources are extracted, ownership of the machines which produce products, and control of the workers making the things.

We cannot continue with this model because in a finite world it will always consume all resources and destroy all life. We should not continue because it inflicts misery and fear on all but the small group of people who own and/or control the system.

Furthermore, even things which are not based on this model, like writing books or software which can freely replicate on existing hardware, are forced to conform to the basic logic of this model. While money no longer literally represents metal dug up from the ground, the *metaphor* of money is still based on that. No matter what anyone does, we all need money in our existing system to survive. Under the existing system if a group of people with no money all want to build a thing, they

can't do it without someone with money-creation authority blessing the activity. People can physically do it in theory, but as long as the material needs of survival are controlled by people who demand money for those things no one but the rich can afford the luxury of doing useful things for which there is no monetary incentive. This means that the more people in society produce things which *don't* require digging things up or doing manual labor, the larger the gap will be between the money production process and actual creation of value. This is the reason inequality will always get worse as the information economy grows. Everyone in the information economy is making money from replication, while the old economy still runs on production. The more powerful information technology becomes, the larger this gap will become, and the rate of increase will keep accelerating.

What we need to recognize in order to move beyond this system is that we must transition from a consumer society to a replication society, and to change our value system to reflect that. In the last 300 years we have dug up a staggering quantity and diversity of material. None of what we have dug up to build our shared global industrial civilization in the last few centuries is really "thrown away". It's all still here, and generally way more of it than we want. Some of it is in landfills, some of it is in wasteful machines that have not reason to exist other than to keep "the economy" going, and some of it is in poisoned water and soil, but all of it is still around us in

some way.

The laws of physics and chemistry will allow us to re-use all these elements indefinitely just as natural ecosystems have with simpler elements for the duration of life on Earth. We can in some sense think of all the trash, toxic waste and useless junk we have created as the “hardware” on which we want to create the “software” of a just and sustainable future. In this model, value comes from the power of replication, rather than production.

In a consumer society, every producer is in competition with every other producer. In a replication society, creators benefit from replication. This creates an incentive system for creators which is the opposite of the existing one. If I find a way to extract a poison from a river using simple and readily available materials and transform it into a usable material for building things, it is in my best interest for that to replicate. I want other people to copy it because only then will *all* the water get cleaned up. I want other people to copy it because the more people copy it the more people will improve upon it, and I will end up with a vastly superior technology to the one I started with, making the river I live on cleaner than would have been possible without the broader community of creators.

Replication societies are nothing new. They are much older than the production model. Any indigenous society which lives in equilibrium with its environment is replication based. When people living in a forest use a tree

to make a boat to hunt an animal, that is a replication economy. They use culture to replicate the boat-making process, and stewardship of the forest to make sure there are always more trees and animals. The old boats rot and turn into soil which gets turned back into trees, they teach their children to pass along the system after they die and turn back into soil themselves, and the system replicates. What we propose here is to take this older and proven social model used by indigenous civilizations and apply it to the materials and principles of modern machines.

So how do we do this? If all the science needed to build a replication based civilization exists, why are we not doing it now? To build this world we must recognize what the hard part is about this. It's not building the things, we know how to do that. It's not organizing people to do things, we also know how to do that. It's the replication of the *desire* to replicate a thing. That is what we call "magic" for the purpose of this work. We use this term because no other term fully expresses the mystery of the process by which we acquire the desire to do a thing.

Under the current system, desire to replicate plays a minimal or hidden role. Most people work for money out of fear, create the systems to do that out of greed, and consume based on being controlled by a media which exists for the sole purpose of stimulating consumption. All these processes are separated from one another. We pro-

duce at a “job” and consume separately. Anyone not producing or consuming using money is treated as a burden on the system.

But if we want technology to replicate freely, we need to harness that spark which causes a person to suddenly feel a desire to create and share a new thing. That spark cannot be reduced to rules and numbers and laws of physics. It is the spark that makes us human, which gives us free will or the human spirit or soul.

Every single technology we use today relies on this magic. Every computer, every jet airplane, every factory and medicine—all these things began with some spark in an actual human which was passed on to other humans. Technology producers today have mechanistic models for their technology which ignore life. We use the provocative term “magic” to re-center all our thoughts about technology on life itself, starting with the human spirit and going out to the living world around us. Life is self-replicating and we identify this word “magic” with all living things. We reject any model for our world which is not centered on the magic of life itself.

So where does this leave us? We want to transition back to a replication society while retaining the most useful modern technologies. We are currently trapped in a system based on scarcity that no one can leave. So how do we get from one to the other? We must first recognize that the most powerful engine of change in modern society is social networking. Working alone, any technology

we create is of almost no use. Everything we create requires that we find ways to collaborate and find people to share with. The core technology structures all other technology is how we communicate with one another in complex networks. If we want to build a radically different world, we must therefore build a radically different social network. This work represents the creation of a social network for the sole purpose of empowering this replication economy.

The transition from a consumer to replication society means replacing the “means of production” with the “means of replication” as the fundamental element of our model of society. Of course we will still have machines that build more machines and people operating those machines just as we do today. But we recognize that the most fundamental thing is not those machines but the social network which tells others how to build those machines and more importantly *why* they should build those machines. This transmission of the “why” is what makes the process require our use of the term “magic”.

In order for this to work we need to have media which supports self-replicating documents which tell us how to replicate technology, and this media itself must be self-replicating. This means the media must carry on it documents which in addition to copying freely from one device to the next must tell people how to copy the actual physical devices.

Once this process gains momentum we can use it as

the basis of a whole new economy which allows us to progress into a full replication system. However, initially we are back to the problem of trying to survive without money in a system which literally won't let us live without it. Our way out of this is with a middle path in which we build social media on hardware which can be bought cheaply and given away to the community as a free resource for very little money and with no material input from any central entity like a company. In order for this to scale, each time someone copies the system it must provide more value added up in monetary units than it costs to build the copy, including the labor to put it together.

This is much easier than it sounds. Social media today is a centralized form of power which generates trillions of dollars in commerce, all based on software. That software has its replication deliberately crippled by intellectual property so that a very small group of digital landlords can take money from everyone else in the system. They get away with this because of the very real value created by linking us all up with one another in complex ways. From ride sharing to finding friends to selling and buying things, all commerce can be dramatically enhanced by social networking. If it costs under 1000 dollars to build out a local social network of free book-like documents for a community, all we need is for that to provide 1000 dollars of value and it will replicate. In even a small and poor community this is an infinites-

imal fraction of the available commerce which can be amplified by social media.

We do not aim to build a “new social media platform”. We aim to build hundreds of millions of truly independent social media platforms, all of which simply replicate documents from one to another, and all of which exist for the primary purpose of building out the replication economy which will transition us off of consumption.

To do this in the long run we will rebuild the hardware from the ground up along the principles of Geometron laid out here. But we can’t get there until we have a self-sustaining system which is financially self-sustaining in the existing system. At its core this means finding a way to harness the “magic”, the core spark which makes a person want to engage with a thing.

Geometron is a way of thinking about technology in which we think of all technology as a geometric construction. Shaping metal into machines is a geometric construction. Displaying symbols on a screen or on paper is a geometric construction. Printing electronic circuits on a board or chip is a geometric construction. All the symbols we use to communicate with one another are geometric constructions. In Geometron we rethink how we program and control machines based on this idea that geometric constructions are more fundamental than those using numbers. Numbers are useful tools, but we choose as a matter of values to always place them in a subordinate role to geometry.

This is the origin of the term “Geometron”: “geometry” combined with the “-tron” ending which is associated with machines. The work here demonstrates using this method of geometric programming to create a wide variety of useful things. We replace “computer programs” made up of numbers, algebra and broken English with geometric constructions represented with geometric symbols.

This book is therefore combining “Geometron” with “magic” by building social media based on these ideas about self-replicating media and geometric thinking, together in a combined whole. The previous book of Geometron was more technical and also less action oriented. This work intends to both tell you why we need to build this system and very specifically how you can immediately engage by copying parts of it and recruiting other people to copy more of it. We are asking readers to *participate* actively through direct action. We are asking you to tell people about this, to share these ideas and build on them. We are asking you to help us build a world of abundance from the bottom up through direct action.

Chapter 2

Trash Magic

HOME

2.1 Trash Magic

Trash Magic is a mode of existence in which we can replicate everything we need to live a good life locally using the waste streams of the existing consumer system. We are using the word “magic” as in the rest of this work to refer to the replication of the desire to replicate things made from trash.

Full Trash Magic is the ultimate objective of all this work. Under full trash magic, all people, everywhere in the world, can get food, shelter, medicine, media, sanitation, water, heating and cooling, and the machines to produce all these for free locally. We will abolish all

mining, all oil and gas extraction and all global physical supply chains.

In order to achieve this objective we begin small, with something that immediately provides value, and scale up based on replication of the thing which provides value. If we can do even the simplest thing which just barely provides a small amount of value from trash but *replicates* and *evolves* with intent, we can then simply guide that evolution and growth to navigate to the complete system as we engage more and more people with more and more specialized skills and resources.

To start all this, we turn to the industrial revolution as a guide. Much of what powered the industrial revolution was using new energy sources in the form of coal and steam to build machines which build other machines. Also, textiles have always played a central role in technology replication, as their products become central to people's culture, which replicates and brings the textile production machines along with them.

In analogy to all this, we want to build the smallest possible factory, which we call a Trash Factory, which mimics this pattern but without mining. We want to build machines that can build machines, or a machine shop, powered by the local forces of the Sun, wind, and flowing water. A machine shop is a collection of tools which can work metal into the forms needed to make more machines. Machine shops are how metal machines traditionally replicate themselves. We need to be able

to melt metal waste into metal ingots then process that into bars, sheets, rods, wires and blocks. Then we need milling machines, lathes and drill presses to machine them into desired shapes. We need the tools of sheet metal work like the brake and bender. We need an arc welder, torches and some other basic tools for soldering, welding and brazing. All this must be made from trash.

Building a machine shop can be based to a large extent on junk cars. Cars have plenty of steel, plenty of parts to salvage without any melting or casting, and electrical tools which can be used for motors and so on. As much as possible we will use things as we find them without reprocessing. If we can, we'll just get donated old stuff that is broken and fix it. The machine shop maintained by people good at fixing broken stuff is as old as the industrial revolution, we just aim to build this into the rest of our self-replicating media system.

The machine shop also needs to have tools for working plastics, with molding on metal molds created using the metal shop, and plastic welding and rework tools. An electrical shop is needed for electric motors and generators.

A fully functioning machine shop which is optimized to build more machines from junk cars can be a self-replicating and self-sustaining factory just by selling machines. We can sell drill presses, milling machines and the like for money which can support the people who build and maintain the system.

In addition to the machines which replicate themselves, we will build all the tools for creating trash-based clothes on site. We will build or fix broken sewing machines, and use them to create fashionable and functional original clothing of all kinds for all people for free to those in the most need. If our story replicates as we hope it does, and people believe in our mission, we should be able to support all the work to build the system, to operate it, and to deliver the free clothes to those in need by selling high end fashion to those who can afford it. All clothes are made on site with waste clothing donated from those in physical proximity to the Trash Factory.

All the motive power for Trash Factories is provided by one of three main sources: heat engines, water drive, and wind. An essential technology which must be integrated into the first generation of Trash Factory is the trash-built Stirling Engine. This is a very simple heat engine developed in the 1800s and used widely ever since which can turn heat into mechanical motion by compressing and decompressing a gas in a sealed chamber with a piston. These engines have been overshadowed by the internal combustion engine or the giant steam turbines used in large scale commercial power plants, but they work well and are well understood and simple. The primary means of driving a heat engine in Trash Magic(without setting things on fire) is using the energy of the sun focused via mirrors onto a heat absorber. Large arrays of mirrors can be built from trash which

track the sun and maintain the focus of the sun over a large area onto the absorber. The other robotics technology that is part of Geometron(Arduino-driven stepper motors) can be used to steer the mirrors as the angle of the sun changes. Stirling engines can also be run backwards, creating a heat pump when the shaft is turned. This means they can be used to cool things, being the basis of solar-powered air conditioning and solar-powered refrigeration. Solar powered air conditioners sound almost too good to be true, but this has been demonstrated well over 100 years ago, it is just not used today for economic and social reasons. The heat engines are also a very good commercial product which can be sold(as an off-grid power source) for money to support the rest of Factory operations.

Water and wind are both pretty traditional: we simply build rotors for both from trash and source the drive trains and generators from trash. Water can be waves, tide or streams/rivers/creeks. In all cases, we envision a factory which has between 1 and 5 people using it at a time using between 1 kW and 100 kW.

The absolute maximum available solar power is about 1 kW per square meter so at 100% efficiency(which will never happen) this is up to about a 100 square meters. If we imagine getting a pessimistic 10% efficiency, that's up to 1000 square meters, which is about 30 meters on a side or about 100 feet on a side square(about a quarter acre or 0.1 hectares).

A reasonable site for a Trash Factory will be about 1 acre, or about 4000 square meters or 0.4 hectares. This will be enough space for a machine shop, the power station, and the various staging areas we need for incoming waste streams and outgoing product streams. When possible we site near flowing natural water and use extra power to both pump water uphill and to clean it up for drinking. Water can then be both used to drink and used to get energy back out as it flows downhill from a water tower or hill top reservoir. Our goal is to be a very scaled-down version of the River Rouge factory from the Ford Motor Company from the early 20th century, where a constant flow of raw trash (instead of raw material from a mine) comes in one side and a flow of finished manufactured goods flows out the other side.

The Trash Factory can be sited based on convenience to resources, cheap land zoned for heavy industrial activity, and easy access. It does not have to be an ideal retail location. The retail side of the Trash Factory is free stores and existing shops. We can make things to directly provide for free for those who want, providing warmth and protection with fashionable and well-fit clothes sourced from local trash while also sourcing products for local stores shelves we sell for money to support the Factory. This also applies to all the machines produced in the machine shop: we can sell welders at a welding shop, heat pumps through an HVAC distributor, drill presses and machine tools to auto shops, etc. Also, providing a mix

of free and commercial products to our local community creates the human relationships we need to establish to keep our supply chain flowing of trash we get for free from existing waste streams.

Again, the Trash Factory aims to always produce more value than it consumes, both bringing in enough cash to support the people operating it and the land and also providing material support for whoever is the most wanting in the local community. Every kilogram of mass we convert from trash to products locally takes that kilogram of mass out of both the landfill waste stream and the mine stream of consumer society. If we can make this replicate and evolve, we can keep removing more and more energy from that system over time, and pumping more and more energy into our system. As long as replication of this system takes less energy than replicating the existing systems we will naturally consume the old system for reasons of simple thermodynamics.

But where does “Trash Magic” fit in with all this? Trash Magic refers to the transmission of this system of trash-built and trash-sourced factory using the self-replicating media platform described in this work. Every machine, article of clothing, every clever hack and structure of business or organization will be documented in a library of books which are kept on free media and network infrastructure we build into all of our systems. In the beginning this will be the Raspberry Pi based system which starts building our network, along with off the

shelf commercial wireless network infrastructure. As we develop our system it will evolve into the fully trash-built media described later in this work.

Full Trash Magic involves taking the Trash Factory system described here and scaling it up to all things we need. As we grow we always direct all excess value created by the system once we support ourselves into helping the most needy in the immediate physical community around the Factory. As this pulls more energy into the system, we will be able to get access to more land and resources outside the property system. Directing resources to those with the most needs first will abolish poverty in very localized areas. Abolition of local poverty will enable more space outside of the property system to flourish, on which we can create products which are all outside the property system.

This will ultimately include the whole set. We need to build fresh water generators from dirty water, and build a toilet infrastructure which turns human waste into compost which is used to grow things locally including hemp for toilet paper(which can also be a product of the Factory). This waste disposal and composting system will be integrated into a system of local synthetic biology, where we use modern biotechnology techniques to control microorganisms and fungi to make all the medicine we need on site. Again, building bioreactors which can make all medicine is nothing new, we just need enough human energy in the system that we can attract the talent in the

form of experts who already know how to build such systems. Our aim initially is not to invent anything, but to create the social connections which allow people with expertise to connect with real local community needs and then to scale that through self-replicating media. If we can make clean water, machines, clothes, medicine, food, and media on site, we have a system which can sustain human life without mining or oil as is our goal.

Again, we must reiterate that this is not some futuristic hypothetical technology. Creating free web pages on free computers which tell you how to make things from trash is simple. Making things from trash is known. The waste is plentiful. The needs of the most impoverished and marginalized people in any given local community are known. The mass peer to peer media network of the Internet exists which can spread all of this. All we are saying with this work is that these dots can be connected. The only thing missing is the *will* to connect these dots. And of course while we might already have the will to do it, what we need to make it scale is the ability to create specific detailed plans and replicate the desire to carry those out. The media platform documented in the rest of this work will allow us to do this. The revenue we will generate by simply building the free social network of free books will provide the startup capital(not financial capital, but resources like land and human attention) to build our first Factories.

Full Trash Magic can exist on just a few acres with

just a few dozen people. We can achieve this in our lifetimes if we focus on our objective and work together!

Chapter 3

The Pibrary

HOME

3.1 The Pibrary

The Pibrary is a network of free books distributed using the Raspberry Pi, a very cheap open source computer designed primarily for educational use. The goal of the Pibrary is to be an extension of the public library system into more public spaces and with more free and more local books.

The Pibrary represents a fully free network, meaning everything is free of copyrights or other intellectual property, everything is available in a public space for use by whoever wants to use it, and everything can be freely replicated by other people in other places.

The Pibrary is centered on public spaces, meaning spaces anyone can get access to without any restrictions such as public parks or public streets or any other outdoor space which we do not restrict access to based on money. This can include private property as long as the owners of the property are willing to create a truly open space which welcomes all people regardless of social or economic status on a 24/7 basis.

The free computing element of the Pibrary consists of mobile raspberry pi computers with portable battery and solar panel as a free community computing resource for use in public spaces by whoever has the greatest need for free access to information. This is to be an extension of other mutual aid projects like Food Not Bombs which provide basic goods and services for free to the most marginalized people in public spaces. The solar panels and batteries can be used to power or charge mobile devices, a critical infrastructure need for unhoused or traveling people. The Raspberry Pis are installed with no private data, no logins, no passwords, and are intended to be used that way so that they can be safely shared. The only purpose of the Pi is to access the Internet for free, just like a free public computer in a public library.

The basic Raspberry Pi mobile terminal setup consists of the Pi board which is about the size of a deck of cards and costs about \$60, the SD card the operating system is installed on, a keyboard, a mouse, a small mobile screen, a 12 volt lead acid battery, and a solar panel

and charger. The whole system costs about \$400 and can all be purchased online from many vendors. In order to charge devices the kit must also have a 12 volt USB power hub to break out the battery power for charging USB devices.

The Raspberry Pi is also used as a home web server for creating, editing and sharing the self-replicating documents of the Geometron system. To run a Pi at home we need a lot less infrastructure. The keyboard and mouse and a standard TV or computer screen can be used once to set it up, it can be powered off of a wall plug, and then run “headless” with no screen or peripherals, accessed over entirely over the network. This server can be accessed by people anywhere in the world by using port forwarding over the home router or router in a public space to connect it to the outside Internet.

Internet access is provided for free in public spaces by wireless hotspots with clearly posted log on information. We can beam Internet into public spaces with directional antennas and wireless network extenders. All of this physical infrastructure is provided for free by donors from the local community. It is a public resource.

The primary purpose of all the media hosted on the Pibrary system is to create a free library of books which contain all the knowledge required to build a society based on the principles of the last chapter: built from trash and powered from the sun, wind and water. This will include science, technology, history, culture, com-

merce, and any other deep knowledge about and for a local community. All of these books consist of collections of documents which replicate freely from one server to another without any restrictions. Each copy of each book can also be edited, deleted, or moved around on any server by anyone at any time.

The Pibrary is a network of free self-replicating books. This is not a network of users. There is no private data, there are no users, no logins, no passwords, no encryption, and no databases. While we are creating a vast universe of documents, each Pibrary will have a collection which is limited based on a focus of immediate interest for a relatively small community with a shared purpose.

Part of the infrastructure of the Pibrary is domain names for public use which can host copies of all the documents in our system. All of these public web pages, like the Raspberry Pi servers, have no private data, no users, and no databases. Anyone can copy files onto them and off of them, or delete them at will. Pages can be forked down to make more libraries with more books and more libraries inside libraries. Whole forks can be deleted by anyone at any time. Our resilience against deleting is to constantly copy books to many places again and again. We are building media which behaves as a living organism, replicating, dying, and evolving as part of our culture as humans.

The domain names for these public web pages are selected to correspond to public spaces like streets, parks

or bodies of water, with top level domains other than .com so that they are non commercial and not personal. Some volunteer from the community can buy the domain and pay for commercial cloud hosting at some standard web hosting vendor, and install the system on that server. It generally costs about 10 dollars a year for the domain and another 10 dollars a month or so for the hosting. As long as our network is providing significant community benefit this should be a relatively minor cost to get paid for by a volunteer.

We create physical flags to display in public spaces which point to the domains which host the books. These flags are created by sewing solid rainbow colored felt letters in a block font onto a black cloth background about 3 feet by 3 feet square. Flags, like everything else, are meant to be copied widely and displayed publicly. Flags fly in physical spaces which are represented by domains which host books we create, edit and replicate using the network of free Raspberry Pi computers.

Another powerful tool in our network of self-replicating books is Github. Github is a company which provides free (free for open source and that includes everything we do) hosting of documents which can be copied from anywhere on the Web. We can create private instances of Geometron servers on home personal computers which have local web servers set up which only run on that machine. These are used to edit local copies of the whole system including any books we want to save. As these are

replicated and edited, they can be “pushed” to Github with Github Desktop, a GUI app. Using Github to move books around provides a backup where if servers are all wiped out the data can’t be edited without access to a personal Github account which is based on Github’s security. Also Github has enough bandwidth and protection against surges in bandwidth that it can be a source for replication to many servers all at once. Anyone anywhere in the world can copy whole libraries of books with simple clicks in their web browser to their personal Github repositories, then push it out to the public and copy from there to any other server. This network of potentially millions of Github accounts and millions of Raspberry Pi’s and millions of domain names can be constantly supporting a free flow of replication of books from server to server across the globe.

The format of “books” on the Pibrary is the “magic book” described in the next chapter. This library of free books can form the basis of a social network which provides the same benefits of modern networking applications but with direct community control. Books can be created to document all commerce, organized by the people engaging in that commerce. The same efficiency improvements which are currently monetized by Silicon Valley can then be kept in local communities, which brings in enough wealth to materially support the people building the network. As the amount of wealth generated by the network increases we will direct all excess to those in

the local community with the most need.

The use of the Network to direct resources to those in the most need is mutual aid. The network helps people and those people help the network by representing it in public, sharing the information with as many people as possible. This applies to everyone. As the network generates more wealth it should be possible to eliminate poverty in very localized areas covered by the network. As this happens we can use the network to build more and more industries up using the Trash Factories and this can amplify the process. Network value in commercial activity funds industrial value which funds more network expansion and so on. As the network grows and we can support more people, those people can solve harder and harder problems and scale up what we can make in the Trash Factories more and more. As this knowledge is generated, it will all be synthesized into more free self-replicating books which are published onto the Pibrary network. So our manufacturing supports growth of the network, but the network is also supporting the growth of manufacturing by replicating all the knowledge required to copy our processes.

The Pibrary creates and enhances public spaces. Selecting the right physical space to inhabit for this is one of the most important parts of building a successful network. We need to choose spaces that have the absolute maximum possible intersection of people. We must ask the question: if a place is about 10 yards across, what

place in a given area a couple miles across has the widest range of people crossing it in any given day? Of places like this, what is the most freely accessible? We must evaluate accessibility based on sidewalks, access by car, access by public transit, by bike, wheelchair, or any other means of access relevant to the local community. But we must also consider accessibility in terms of it being legal to be there, there being adequate restroom facilities nearby, places to rest or work or sleep, shade or other shelter, and a generally welcoming culture.

The public space being activated by a Pibrary does not need to always have a Raspberry Pi or solar panel. It can just have a flag or sign or markers which point to the domain which has the copies of the books maintained about that place. It can even be invisible, with a known domain being used by people about a place without any obvious infrastructure in that place other than the place itself.

The Raspberry Pi can also serve as a monitor for the environment, measuring aspects of the water, air, soil, living things and anything else of interest to the community. In rural areas, sequences of wireless network repeaters on off-grid power can go along rivers and streams with local Raspberry Pi's with sensors measuring water properties and delivering that information via the web to the rest of the network. This can put the land, life, and water itself onto the network and connect all of us humans on the network more intimately with these sys-

tems.

Chapter 4

The Magic Books

HOME

4.1 Magic Books

The media which drives this network is the Magic Book. The Magic Book is a format for electronic books which lends itself to easy replication across the Internet and easy editing. We use the term “magic” as in all other places in this work to mean that people replicate them themselves. That is, with simply copy/pasting links and clicking on them in browsers anyone on a network can copy any book from any server to any other server.

This is not like Google Docs where documents are attached to “users” who log into a cloud server controlled by Google. We use cloud hosting for public-facing web

pages, but they are all able to be read by anyone anywhere in the world freely without any log ins or passwords. And all these books are created, edited, and shared on the local Pibrary networks hosted on physical Raspberry Pi based web servers which are shared freely in our local physical community.

Also, we are using “book” as a metaphor. What is a book exactly? How is it different from other media? A book can be physical or digital, can be a private document or public. But what distinguishes it from things like articles or news is that it is self-contained and encapsulates a large body of knowledge in a coherent whole. A book can evolve over time and can get re-written but it has a fundamentally different structure from the news feeds which dominate social media today. Also, we distinguish these books from wiki’s like Wikipedia. Wikis are databases of articles. These articles are the fundamental element of the whole thing, and are not organized into book structures. It is hard to write down a clear definition which distinguishes an article from a book, but for our purposes a book is a collection of chapters, each of which is a text document, and all of which add up to some coherent whole.

All books are released by their authors into the Public Domain with no restrictions whatsoever. We do not use the kind of restricted licenses favored by Creative Commons or the Free Software Foundation, but explicitly release books under the Public Domain.

Books, like everything else in the work described here, are self-replicating sets. That is, collections of things which all replicate as a set easily by anyone on the network. The main element of these sets are called scrolls and these are just text documents in the Markdown format. Markdown is a very simple text format which is used in a wide range of online content, which in its simplest form is just raw text, but has a few simple additions like using asterisks for italic, double asterisks for bold, and number signs for headings. While using a markup language like this with a little bit of syntax is in some ways more complex than the completely point-and-click driven editors like Word or Google Docs, this is designed to make the documents compatible with pure-text formats, which is important for making them easy to replicate and edit as we move them freely across our network. We believe that the usability cost of Markdown is worth it for the usability gain of being plain human readable text. The Scroll format used in this work is Markdown converted on-the-fly into HTML using the open source JavaScript library showdown.js. This allows us to set format parameters like font, size, color, and how text fits in a screen using standard web development methods, adapting the same text document to any look and feel or screen size we want(a huge advantage over pdf). This reliance on standard web development methods allows us to have our format work well on all web enabled devices from mobile to tablet to desktop to big screens and of

course our free public Raspberry Pi computers without any software other than the browser.

While our primary media format is in the web browser, it is also useful to be able to generate physical bound books, also for free distribution. There are a number of ways to do this, but the one we recommend and are using for this work is LaTeX (pronounced LAY-TECH or LAH-TECH, the “X” is meant to represent the Greek letter “Chi”), and document formatting system developed for the typesetting of technical work. Like Markdown, this is a human-readable text format in which standard text characters are used to indicate to the computer how format will work. For example, while Markdown uses asterisks around a word for italic, LaTeX uses a backslash command “`”` along with curly brackets around whatever goes in italic. The most important thing about using LaTeX is that for when we create more technical works diving into the physics, engineering and math needed to build the world of full Trash Magic that it makes that easy. This system is already widely used by technology creators and scientists so while it has a steep learning curve it is useful for the experts we are inviting into this system to create works. Also, it is compatible with a number of other web-based systems of technical documentation like the Jupyter Notebooks which are an almost universal means of communication now in applied sciences where calculations are done on data using Python or other popular data science languages like

R. Another widely used and open source Javascript library(Mathjax.js) allows us to optionally turn on this math typesetting in the Markdown-driven scroll documents as well, so technical books can be written entirely in the Pibrary format and then moved to LaTeX with the math formatting staying the same. Conversion from Markdown to LaTeX can be enabled with Pandoc, the "swiss army knife" of document formats(see pandoc.org for details). Once a book is in the LaTeX format it is compiled into .pdf in whatever book size is appropriate. We generally use this to compile to two formats: the letter size in the US or A4 in metric countries for printing on standard home or office printers to bind in three ring binders and the 6x9 inch format for binding from print-on-demand publishers. We use Lulu Press(lulu.com) to create the bound copies in various formats.

The exact means by which books are replicated will be discussed elsewhere, but essentially it is all based on building links to scripts which can be run from a browser which fetch lists of files and use that list to fetch all the files. The best way to learn how to do this is by example, and the replication of this work will involve directly showing people how to do this in person, via video, and via real time online communication we will be setting up in the coming months.

So far we have discussed the format of the Magic Books but not the purpose or what books we will share first. The purpose of the library of books we are creating

here is to be a repository of all the knowledge needed to build full Trash Magic. This means we need to create a culture with everything that goes along with that: history, philosophy, politics, technology, science, math, and all the wisdom required to be stewards of the land we are a part of. This system of books also needs to self-support. This means that as a social media platform it needs to generate economic value measured initially in money which can provide material support to those of us creating and replicating the network.

The beginning of this library is the books created by the author of this book, Trash Robot. This includes the Trash Magic Manifesto, the Trash Magic Action Coloring Book, and the first Book of Geometron, as well as this book, Geometron Magic. Trash Robot is also in the process of creating another book, Trash Physics, which is part memoir, part criticism of the structure of modern physics, and partly the start of a whole library of physics texts based on the principles here.

The way the library of Magic Books we describe here will become self-sustaining is by documenting the commerce in local communities in a deep and organized way that no existing resource does. This is not just a business directory. It is the creation of a new level of social networking in physically local spaces that does not exist on today's Internet. We will work with local people to create books on local history, local culture, the local economy, the local government, local mutual aid and

outreach organizations, local libraries, local religious institutions, and compile all of into books which are shared on our system. Again, this is not a wiki covering existing things. This is a library, creating new deeper connections than exist today, diving deeper into history and culture than the existing Web does. It is also not news. We aim to create new social links in physically local spaces with our system which enable people to engage in new commerce with each other locally. We call these books the Books of the Street, where the “street” here refers to a local public space where we site the Pibrary discussed in the previous chapter.

The Books of the Street are doing more than documenting existing networks and businesses and people. They are *creating* social networks of actual humans in a physical space which do not exist in today’s globalized world of cars, planes, and long distance communications. They represent a cultural shift to extreme localization of communities localized to just a couple of miles across, which still maintain the flow of global information across the entire human race.

Creating connections between people which did not exist before can enable commerce. Enabling commerce creates cash flow in exactly the same way it does in centralized commercial social media. This cash flow generated by the network creates a strong incentive for network participants to materially support network creators. Supporting us, the network creators, allows us to spread

the network, and if that spread generates more value wherever it goes, that becomes self-sustaining in growth. Initially, this network is simply a social media platform which provides a totally free, non-capitalist (no money, no property) resource to those in the existing capitalist economy. If we can scale with positive cash flow in each local node, this creates a much more efficient scaling mechanism to existing venture capital backed technology startup companies, which generally scale at a loss in order to gain market dominance. Without the billions of dollars of venture capital money required to scale, we can move faster and be more adaptable than those networks, enabling us to ultimately take away all their market share bit by bit from a bottom-up approach.

Consider any “technology” company today which makes its money on creating links between people. From ride share to dating to advertising, all these companies are simply connectors. They connect people with other people and then demand rent from us for doing so. A free network driven locally from the bottom up with community owned hardware and no intellectual property can easily defeat this network one street corner at a time. We can take Silicon Valley down to zero if we can get the right growth model of our network, and it is in the best interest of all people that this happen as soon as possible, since the predatory model of Silicon Valley is destroying us all. We are asking people with great urgency to contribute to this campaign.

Chapter 5

The People of the Network

HOME

5.1 People

The heart of a network of people is the *people*, not the technology which connects us. We aim to build a network which can materially support creators on the network. To do this we must make the network provide so much more benefit to participants than the cost of adding physical infrastructure and providing support to the creators that people will do so out of self-interest.

We aim to build a network which helps as many people as much as possible. We aim to start by helping the

most marginalized people with direct assistance in the form of communication, knowledge and power resources. From there we aim to connect all the other people who share physical space in local communities.

Big Tech doesn't care about anyone's community. They provide just enough increases in efficiency and human connection between people to get us addicted to their products, then extract all excess value that they can using the power of monopolies to create a vast suction of value from everyone everywhere in the world to the professionals of their industry.

Multiplied by hundreds of millions of communities, this leaves trillions of dollars on the table in commerce which can be recaptured by local communities away from Big Tech. If we can provide more increases in efficiency and more human connection than Big Tech but keep the value in our local communities, we should be able to take every single dollar out of their system, to totally destroy Silicon Valley. Our long term aim is to purge the Earth of them, to totally destroy the culture and society of the so-called "tech industry". We should be able to engage in commerce anywhere in the world without sending a single dollar to California.

This all starts with the simple act of creating networks of people dedicated to the shared goal of building out this network.

The physical machines and digital files which make up the technology system are released by the creators of

the network from the property system in order to make replication more free.

This chapter is a recruitment request. We are looking for all these people to join us, to join this movement and this network. We need you to collaborate to share knowledge and resources to help build this. Ultimately we want this network to belong to everyone everywhere, but right now we are directly asking all the people below to reach out and collaborate to immediately bring this network into being in the physical world.

The people of the network. We create this network to support ourselves. We believe that building and releasing for free these resources can create enough value for enough people that they will support us directly to keep freely creating and sharing. It is my intention to live this way as soon as possible, to get food, shelter, medicine, transport, technical resources, and places to work provided by people who benefit greatly from the expansion of the network. This will start out as a very hard thing, supported by a few large donors and many small donors, and will become easy as we get network scale effects. The author will become a person of the network as soon as I possibly can.

Public Librarians. The Pibrary is an extension of the library system. The public library mission is make knowledge as free as possible. The pibrary consists of freely created, edited and shared documents on free hardware maintained in public spaces and available to all.

Public libraries currently serve as a computing and Internet resource for people with no other access. The Pibrary brings physical computers out to the streets with 24/7 access, taking some load off of the computing resources in the physical library, and extending hours and accessibility of the resource. By being useful for other communities, the Pibrary can be self-supporting, extending the reach and impact of the library without costing money from the base library budget. Pibraries also extend the effective collection of the library, as user-generated content is all completely free and openly shared, replicated globally from one to another potentially over billions of servers. As we scale up, it should be possible for a local public library with almost no budget or resources to have access to a very large collection of free titles. Libraries with maker spaces already have STEM education curriculum and often already have Raspberry pi's, and this network simply adds to the impact of that, adding content to it.

Authors. If you are someone who writes for the common good of humanity who believes in free knowledge without the limits of intellectual property, the Pibrary can be a platform for creating explicitly free work. As we scale, the intent of this network is to have authors created through direct material support from the communities we serve. If we can get authors generating knowledge to provide all the good things in life, this will be a self-sustaining system without money. In the short term, it

can sustain authors via driving traffic to voluntary support pages like Patreon or links to buy physical copies of books with a profit built in from self-publishing platforms like Lulu press. No work may be posted unless you relinquish all copyright to public domain. No exceptions.

Unhoused people. This is a mutual aid based network. This means primarily that we are providing fully free infrastructure and services in public spaces on the streets, directly controlled by the people who need it. This means we will provide free wifi hotspots, free solar powered device chargers, and free easily portable physical computers you can use 24/7. It also means that we will be co-creating documents which have all the resources available in the local community including contact information for aid organizations, jobs, housing resources, harm reduction organizations, and anyone else who is providing resources. It also means we are going to be asking for your help in sharing and growing the network. If our network grows we will eventually be able to make all the things of a good life free for all people, and the only way to do that is to provide for those who have the least first. And the way to do that is to incorporate you directly into our emerging community, where you can actively engage and contribute by sharing your own stories and creations with the other readers and creators on the Pibrary network.

Teachers. This system can be used by writing teachers to help students co-create published books directly to

their local community as an alternative to papers read only by the teacher. It can also be used by anyone teaching people how to code as a development environment which can be run in a web browser, then published to the network and shared with the world instantly without any gate keepers. Rather than learning how to code in a job for a company, we teach people to code by directly building web content immediately and publishing to the network for other people to build on. Our aim is to transition all teaching from job training to direct creation of useful resources for people's communities. The Raspberry Pi can save a lot of money as a low cost powerful computing resource, and the more people we share this with the better.

Traveling kids/dirty kids/crust punks. Think of the Pibrary as a deep sign, or perhaps "hypersign". A cardboard sign, cloth flag with url or QR code can point to a web-based mirror of the chaos books. These books can have *anything* on them. You can share your stories, share whatever you have to share, to sell, etc. By forming connections with other people who maintain the networks and are supportive, you can maintain documents for free online with no gate keepers, no censors, no algorithms, no passwords or logins, just free things to share freely which can help get the information out there that you need to get the aid you need to stay happy and healthy on the road. You have a critical role to play in growing the network, sharing our resources and story with the

world. This is a knowledge network, a linking of people who inhabit shared physical spaces. You can help us to link up all the social networks which connect in physical crossroads like downtowns and truck stops across the world. And we can help you by helping to promote direct mutual aid to help you on the road. In a world without property, you are also the pumping blood of our network, moving physical goods to place to place without money.

Scientists, mathematicians, academics. This is a publication platform with no barrier to entry. If you produce knowledge you are willing to share freely with humanity, this can be a platform which not only shares what you have created but which is built in such a way that others can immediately build on it. You can write a totally incomplete paper with most of the important parts missing, and if it gets to the correct collaborators, they can build on it and replicate it back to the network and you'll get back something much better than what you started with. This is a new way of doing research, where we do not associate documents with individual people but with a process of improvement where all readers and writers are co-creating the work over time. We advocate letting go of ego and prioritizing progress over personal accolades. However, this publication is still compatible with career boosting publications as it can be treated like free online archives are now with preprints of articles that eventually go into gate kept peer review journals. These documents are compatible with the LaTeX system

of mathematical type setting, a small modification is all that is required to turn it on(documented here).

Keepers of indigenous knowledge. We aim with this knowledge network to bring back a more dynamic living type of knowledge that has existed throughout the world in indigenous cultures for thousands of years. It is our hope that by bringing free computers, free Internet and free off grid power for it all to communities with posses indigenous knowledge that those people will be empowered to share using this platform, both with each other and with the world. Our network is a hybrid of oral tradition and digital methods, where community members are all co-creating documents which are then passed along freely to the whole of the community. The world today is in desperate urgent need of indigenous science and technology if we are to restore equilibrium between humanity and the living world. We need the traditional technology and culture to be able to blend with that of the Internet and computers if we are to navigate the whole of humanity out of our current predicament. Our intent is to get the hardware into your communities, teach your teachers, elders, and other stake holders how to run and grow the system, and then it becomes your network to shape as you see fit. We also aim to have the network of off-grid computers and wireless links connect with environmental sensors, putting the living Earth onto the indigenous network in a very literal way, hopefully giving it more of a voice in the affairs of the

our world as well.

Mutual aid workers, harm reduction, street outreach, community organizers. The library should have a book dedicated to community resources. This can be a directory of links to resources, people, places, organizations, jobs, housing, really anything that is freely available to help people out should get cataloged here and that should be actively maintained by all. Think of this like a phone book for resources for those most in need of those resources(any resources).

People who have too many physical books. You know who you are. You know more than half your books are ones you'll never look at again and don't need but both are not sure which half that is, can't bear the thought of them going into a dumpster due to a library donation drive getting too many books and don't want to lug them all over the place. What you really want is to get them into the hands of an actual reader who will actually read them. The library will have book catalogs of physical books which people are willing to give away(not loan!!!). List whatever books you want, along with either contact info or contact info of someone willing to manage the network of the book exchange. Then if someone wants a book you have they can ask and you can just pass it along with either a meeting or a drop off at a common location like a coffee shop or public library.

Artists. The art you sell does not have to be free, but the media describing it does. This is a platform on

which artists can co-create whole books which catalog the art they create and sell or promote whatever commercial channels they use for that. This is not an advertising platform. Spam gets deleted. But it is a place where people can create long form exposition of whatever they produce and place all that in the context of other creators' art and craft products.

Deep readers. The knowledge which can only be attained through reading a lot of books is of great value to a library community. We need people to put together libraries, to organize content, to edit, and to add manuscripts which are already available for free but not widely distributed. We also need people to curate libraries, to figure out exactly what people can benefit from in a given community. That can only happen with very active participation by people who read a lot, both widely and with some depth into various fields. Reading lists are of the utmost importance.

Practitioners of religion/magic/spirituality. The books we co-create with the Pibrary network are living documents. What better way to transmit wisdom could you ask for? True wisdom does not belong to anyone. True wisdom can withstand the maelstrom of a chaotic co-editing process by potentially billions of readers and writers and end up better than it started. We ask that you consider sharing what you know and what you have learned from your teachers in this truly free form.

Technology creators. One of the core functions of

this knowledge network is to spread the technical knowledge required for people to build a new civilization from the waste streams of the existing one. This requires a whole new way of creating technology, based on free sharing of knowledge over this network. Ideally this can be a self-sustaining way to exist in society as a creator of technology. We can create technology, share detailed documents on how to build it, and it will come back to us with community additions much better than what we built. As the network grows and we build more and more truly free infrastructure (manufacturing, housing, food production, power, etc.) we can eventually fully support ourselves off of this network. We will release our creations for free into the network and get back more free stuff than we put in as the network effect accelerates innovation.

Organizers. The chaos book represents an alternative method of communication which can be very valuable for organizing. Rather than “news”, a chaos book represents a body of knowledge which is bound by a common theme or purpose, not a flow of new information all the time but a reference work of use to all. You can create manuals for organizing, directories of organizers, and compendiums of community stories and issues by asking for input and compiling it all into chaos books.

Local government. Most people don’t even care that you exist. This network of documents can be used to create community knowledge which includes the activities of local government, increasing engagement and

effectiveness.

Art Gallery Owners. An art gallery is already a type of library, as well as a network. It links artists with the public and with patrons. It links art with the rest of the cultural context in which that art was created. And finally it is a physical place, the survival of which depends on how people view its meaning. Building a free book which represents the meaning of the *place* that is a gallery, studio or other art space can act to amplify the value of that place, benefiting the mission of the space.

Chapter 6

Cybermagic

HOME

6.1 Cybermagic

We use the term “magic” here to mean sets of things which include the *desire* to replicate the set. Cybermagic refers to sets of computer files which include scripts to replicate the whole set as well as both documents on *how* to replicate the set and also on *why* we want to replicate it. The files and hardware themselves never warrant the term “magic”. We apply that term only to refer to the property which makes people actually have the desire to choose to replicate the set. It is this human intention which animates technology, and that is what we call “magic”.

Cybermagic is self-replicating code which can all be replicated freely from one Geometron server to the next entirely from the Web Browser. We do not “install” software. We use only code which can be run from a browser without ever logging into a server. To make a self-replicating set of computer programs we have some scripts which copy all the other ones, some files which load, save and delete files, and some which catalog them. This set of files can combine with any other set of files, and together can build self-replicating sets of files, where the *entire* set is managed from a Web Browser over the network without ever logging into the server.

This chapter will get a little technical. It is to explain to people who know some things about computer programs how the software here is structured. For those with limited technical knowledge but some interest, we try to describe all the terms in the hope that this can be an invitation to learn all these languages and become a Geometron developer. Email the author with any questions.

Our intent is not to recruit developers into the project of co-creating this system but to teach people from scratch how to work on it, to build a whole new culture of creating software with no link to the existing one based on profit and control. This is a political and social choice. We believe that the work of professional software developers who work either for money or for free but in support of commercial software do great harm with their work

and that making a hard cultural break with this group of people is necessary to build system which have more decent human values than those that dominate our world today. For this reason, this chapter has to both be a little bit technical to try to invite people to learn and join us, but not technical at a level which assumes someone is already a developer as it is our intention to avoid working with anyone who involved with the software industry at all.

The main formats of files we copy are HTML, PHP, JavaScript, JSON, and .svg. HTML, or HyperText Markup Language, is the primary language of all content which displays in a web browser. It is the language made up of “tags” which are words or letters between angle brackets along with the raw text that makes up a web document. The language used to talk about HTML is very clearly inspired already by the ideas of set theory, as the word “element” is used to describe all of the kinds of things which exist in a document, like paragraphs, images, links and so on. HyperText refers to the way that documents can all link to each other, making the entire Web in some sense one giant document as long as documents all link to each other. It is important to note that the “web”, based on HTML is not the same as the Internet. An HTML document can exist on a machine not connected to the Internet and much of what exists on the Internet(which is just the network of physical devices) is other kinds of traffic like phone calls, emails, and other data. While the

Internet was a creation of the US military back in the late 60s, the World Wide Web, browsers and HTML were all created at the European particle physics lab CERN at the end of the 1980s as more of an academic project. By default, the file `index.html` is the one loaded as the home page on any given web address. So if you point your browser to a domain name without a file name it just displays this file. We always need an `index.html` file to exist and replicate for the system to run smoothly.

JavaScript is the language which is part of the HTML standard which does actions, like making buttons or text inputs work, calculating things, or manipulating the HTML content on a page. Whenever possible, our first choice in this system is to use JavaScript for all code that does things because that can exist either in an HTML file (in the “script” tag) or called directly from an HTML file.

The only language we use to interact with files on the servers is PHP. PHP is a old language by web standards(1995). PHP originally stood for Personal Home Page,[8] but it now stands for the recursive initialism PHP: Hypertext Preprocessor(see wikipedia page). It is a language specifically designed for the task we need: doing things on a web server entirely from inside a web browser over the network. The first and only thing we need to do in order to install Geometron is to copy the program `replicator.php` onto a web server and run it. That’s all! This script calls a file called `dna.txt` which lists all the other files, and the program uses that list to copy every

file in the set. So taken together, replicator.php, dna.txt and all the other files on the server are a self-replicating set of programs all of which replicate when anyone on the network puts “replicator.php” into the browser. This is what makes it incredibly easy, fast, and free to replicate whole sets of documents across our network: it’s just links you can click on. All the code in the set is edited using another PHP program called editor.php. This program uses the JavaScript library Ace.js to add syntax highlighting, and loads and saves files using helper programs fileloader.php and filesaver.php.

PHP files are all stored in a directory called “php”, and use the file extension .txt so that they can be read in a browser without running them. A program called “text2php.php” finds every single .txt file in the directory php and copies them into a .php file in the main web directory. This can be thought of like “compiling” the program, although it really is just copying the files, and not doing anything else to change anything. The dna.txt file is generated using yet another program called dnagenerator.php.

Data like the list of files to replicate are in the JSON format. JSON stands for JavaScript Object Notation, and is another language clearly inspired by set theory and foundational mathematical ideas. All it is is a way to organize information into either arrays of pieces of information like text or numbers or name-value pairs which have a name which is just text and a value which can be

any of a number of types of information. All these can be fractal, with objects inside arrays inside objects and so on. This format is used for a whole range of different Geometron applications to store data.

All the icons used in the system are in the vector graphics format SVG(Scalable Vector Graphics). These are also part of the self-replicating sets. All of these icons are created from scratch using the Geometron geometric programming language, again all from inside the browser over the network. This shows how self-contained this system is. Graphics, scripts, format, content are all things we can create, organize, edit, delete and replicate again and again entirely from within the web browser over the network.

PHP programs can take inputs using the text you put into the address bar in the web browser using question marks and ampersands. This allows people to get a huge range of control over the system from the browser, creating new files, destroying old ones, forking the system into new directions on any given server. We use this for instance with a program called `copy.php` to copy files from anywhere on the network to anywhere on the server we are interacting with. This is also used to create a new file using the editor. For instance we can create a new html file called `new.html` simply by putting into the browser address bar `"editor.php?newfile=newfile.html"`. Then we can edit this new file, click on the link from the editor to create an updated `dna.txt` file, and the set which gets

replicated by replicator.php will now include the new file.

This is anarchist software architecture, one of constant chaos. There are no restrictions. Any code can run anywhere any time by anyone. Any file can be deleted by anyone at any time with no log in, no password, just a click and you destroy anything. The same is true for replication. Anyone can copy anything to anywhere at any time. The only restrictions on what is “private” or “public” servers are based on physical network parameters. Local networks can have servers which are not visible outside the the network. This can allows for networks of servers to exist in a shared public space, with constant local replication, as well as replication *from* all globally available servers, but without anyone outside the local network able to interact with the servers. One can think of a server only on a local network as having a one way valve for information from the global Internet to the local server. We can build communities of constant co-replication and co-creation of documents over a local network. It is wifi anarcho-communism: a wifi network which abolishes the concept of property, the concept of the “user”, all private data, all private code, all private documents, all restrictions on user actions, and indeed the concept of the “self” itself. This is a universe of files without property and without individual identity.

A stripped down set of the absolute minimum collection of files can be useful for understanding the structure. This can be viewed at <https://github.com/LafeLabs/>

`pibrary/tree/main/geometronmagic/cybermagicminimal`. It's just the home page `index.html`, the replicator, editor, `dnagenerator`, `txt2php`, `filesaver`, `fileloader`, and `dna.txt`.

The sets of files we replicate can include any of a few different file types, each of which has their own self-replicating infrastructure to support it. This includes the image set, which is a set of images people can upload to a server, delete from the server, and replicate as a set. There is also a symbol set replicator which includes the whole Geometron system for creating and editing graphics and saving them to `.svg` and `.png` files. There is a generic file set replicator which has not specific format specified. This is useful for files like CAD layout files for circuits or programs other than those in the cybermagic system. One example of this kind of file we will use a lot is the Jupyter notebook, which is a very useful tool for all kinds of science and math calculations and education, already widely used in many fields.

The Map Books are combinations of scrolls and maps which can create swarms of documents which are graphical and text all linked with each other and all of which replicate together. The Map Book can form the basis of physical hypertext documents, which are documents combining maps of physical spaces with hyperlinks to text documents relating to those spaces which can link back to other physical spaces and documents, and so on. Physical places can have physical media pointing to a domain which hosts copies of map books which have links

to documents which act to change that space by guiding people to alter it themselves along with the documents. This creates feedback loops of physical media in physical spaces, mediated by our digital media, which can be a powerful transformative force. This mixed reality media can also form the basis of complex games of many kinds, the structure of them is left to your imagination.

Any set exists at some point on a server and that can fork down to sets in directories, which can fork again and again, making more sets which can be Magic Books, sets of code, sets of symbols, images, or any other file or document. All this happens with a page called `fork.html`, which allows us to create forks of whatever name we want and replicate the book down a level, and the book can be replaced with any other set using another replicator. Any fork can be deleted along with all its sub-fork instantly at any time by anyone.

The only thing that preserves any information in our system is constant replication, just like life, which constantly reproduces in the face of constant death. This is living media. We walk the Earth in the physical world carrying our web servers and our physical media and constantly replicate swarms of code and documents from person to person in our physical space. And we remember that the magic is not in the code or machines but in that spark that jumps from one person to the next when we are able to project our desire to build this free network into the minds and hearts of new people. This is cyber-

magic. Code which carries the media which replicates the desire to replicate the code which replicates the media which describes how to replicate the code, all on physical infrastructure which replicates with us, the People of the Network.

To replicate this system, see the installation instructions in the pibrary Github repository at <https://github.com/LafeLabs/pib>

Chapter 7

Geometric Programming

HOME

7.1 Geometric Programming

All technology is based on geometry. When a screen displays text or graphics, that is a geometric construction. When we build an integrated circuit which is the basis of computers, that is just a complex pattern of shapes on a flat surface, yet another geometric construction, as are the circuit boards on which they sit. Architecture is all geometric construction. The path of a cutting tool or a 3d printer nozzle through space are geometric constructions. The path of a tractor or harvester going across a

field in a sequence of rows is a geometric construction.

Any manufacturing process can be understood as a geometric construction. To build the full Trash Magic we aim for in this work we must create manufacturing processes which replicate from place to place freely over communication networks. If all manufacturing is a geometric process, the most fundamental way to transmit manufacturing processes is to build a language on geometry. This represents a shift in thinking from the dominant machine ideology of today, that of the computer. In the current dominant ideology, the most fundamental things are numbers and arithmetic operations. People think of computers as being engines which use numbers to decide what to do to other numbers. All of the various automation and media functions are considered to be “applications” of this arithmetic engine model.

In Geometron we re-imagine the fundamental idea of machines as always being for doing geometry, and controlled by geometry. This is a philosophical shift, one of values. We choose to value the symbols displayed on a screen and the path taken by a tool for manufacturing as more fundamental than ones and zeros in the arithmetic model.

In computer theory, people have an abstract model they use to describe all computers based on long tapes of ones and zeros which control the movement of the tapes and the operation of doing things with numbers. Computers are then judged in terms of how effectively they

process numbers, in a very numerical way, where more and bigger numbers faster is a measure of power. This has led to architectures which use an absurd amount of computing power, with machines that do arithmetic operations a billion times a second all to carry out some task a thousand times a second, or even every few minutes. By considering the geometric actions to be more fundamental we aim to move to much simpler machine architectures which will allow us to build machines with less intense technology than modern microelectronic fabrication methods.

We aim to close all the loops in machine fabrication, using a geometric programming language to design and fabricate simple circuits which can run the geometric programs which make more circuits and so on. Rather than trying immediately to build the most powerful machines, we aim to get as quickly as possible to machines which are able to run the entire process of replicating them using their own technology, without any external input. The details of this process will be discussed in another chapter, but it is an essential part of the whole Geometron/Trash Magic process to build these loops of self-replicating physical media.

Just as computer scientists create toy models of imaginary machines called Turing Machines(after mathematician Allan Turing of WWII cryptology fame) which act on numbers, we create a generic toy model for how to create geometric virtual machines. This is called the Ge-

ometron Virtual Machine.

In the Geometron Virtual Machine we imagine a tape of addresses, much like the ones and zeros in the Turing Machine. These addresses represent positions in a pair of imaginary cubes in space, together called the Geometron Hypercube. To make things completely geometric, we imagine the physical tape as having a sequence of symbols made up of arrays of dots, where each pattern of dots represents an address in one of the cubes. Each address in the cube itself contains a tape made up of addresses. So this makes thing able to endlessly refer to themselves, since the main tape can reference an address which references another address and so on, building up whole complex networks of geometric actions.

The virtual machine can also do physical things based on each address. This is where it is a different model than the Turing Machine. The Turing Machine can be *used* to control physical machines but in its basic model it only works with “pure” numbers. The Geometron Virtual machine has physical operations built into the definition of its structure. Different areas of the address space do different kinds of operation. The details of this structure are covered in the First Book of Geometron. The most basic operation in our system is display of graphics on a screen. This is because the display of symbols is how the machine interacts with the human mind, and again this points to how this differs from the Turing model.

The Turing model ignores the human operator. It

imagines an infinite tape which can in theory run programs forever, ignoring the humans who operate it and the physical mater it interacts with. In Geometron the human has multiple roles. It starts with a human pushing some kind of “start” button which starts the main tape being read, and we generally assume the tape is finite and that it only runs one way, once(as opposed to infinite, and running forever). Each address on the tape has a corresponding symbol which is in a human readable format, where by “readable” we mean that it has some clear meaning to the human operator. These symbols are themselves constructions of Geometron. We aim for these symbols to *be* the language used for programming the machines which make all our technology.

Our lexicon of human readable symbols we put in the Geometron Hypercube includes the entirety of whatever written language a human operator is normally using, such as English. For instance, for English we have addresses in the Hypercube for each of the printable letters on the English computer keyboard, and each of these represents a sequence of geometric actions which taken together draw that character. In the current software, this means actions taken in a web browser which control where pixels are in a graphic, a physical construction on a computer screen using the programming methods of the browser. This is called a font, just as in other computer software. A big part of what makes these methods powerful is how they can be mixed and matched with dif-

ferent physical means of geometric action. For instance, a font can be constructed out of discrete movements and drawing of pixels which can be cloned from a robot which impresses dots into clay with a nail to a bitmap on a computer screen to spray paint dots on a wall to microscopic laser burns with no change in the code.

This ability to move geometric construction from one physical fabrication machine to another goes to the heart of why Geometron is a critical enabling idea for Trash Magic. When we build our fabrication technology from parts of machines we find in the trash, having this geometric description of what the machine does independent of the details of the machine makes it much easier to adapt programs from one machine to the next as our system evolves. A program to make a square with a tool which consists of “start drawing, move left, move down, move right, move up” can be done at any size with any tool once we build a virtual machine model which maps those movements to what the motors do.

Of course this is all still based on computer programming languages on machines that do arithmetic. But the purpose of computer programming languages is not just to control machines but to make it easier for our minds to think about how to control them, and that is where Geometron really does things Turing machines don’t, by integrating the process of designing languages, controlling automation, controlling fabrication, and building abstract language structures.

We *choose* to consider geometry to be more fundamental than arithmetic. We believe that this choice is not just a mathematical one but a moral and philosophical one. We believe it represents a shift from an information economy based on replication instead of production, communication instead of domination and control. We use the slogan “no war but the math war” to represent this idea, that we believe that the ideology of numbers is integrated into the ideology of permanent war that dominates the world today, and that shifting away from that way of thinking requires this change in mathematical philosophy. The war machine of today is needed to project power over the long distances required to keep the supply chains flowing which keep material moving from the mines to the consumers. Free replication of geometric constructions in locally sourced trash represents a shift away toward empires of control and towards global abundance.

Chapter 8

Symbol Magic

HOME

8.1 Symbol Magic

Symbol Magic, like all the “magics” of this work, refers to self-replicating symbols, which people freely copy using the media network we are building. All our media is designed to be created, edited, and replicated entirely in a web browser. The media we use to control *all* machines in full Trash Magic is to be built this way. Be it a cutting tool, a laser, an agricultural robot, pixels on a screen, or any other movement of any machine used to impart form onto mater, we aim to create all the programs to control this in the browser using symbols also made in this system.

As with all our systems, this begins with the ability of the system to create itself. This means we need to be able to make the web graphics used for buttons and links in our web-based media. If you're using this system to read this book, you have already seen these. Using simple square symbols to represent things they link to or actions they cause to happen is a fundamental element of what makes the web work.

We also must now take a moment to define "symbol" in the broad sense used in this work. We define "symbol" to be *any* geometric construction which has meaning to people. This means a building is a symbol. A pie is a symbol. A culvert or dam is a symbol. A microelectronic circuit is a symbol. All of these things have meaning to people and are constructed with geometry. If the materials used to make a symbol are available locally everywhere in the world and the symbol can be replicated from one web browser to the next, those things can all be replicated. If the system of symbols, which we can think of as a language, also impart the *desire* to replicate a thing, that is where the magic happens, where the things can spread freely from one local community of people to the next across the globe.

The language of Geometron in the web browser is more completely documented in the First Book of Geometron. Here we just discuss how it works and what it can do and what we plan to do with it as the system grows.

Symbols used to represent geometric actions are generally in a square. The symbol itself is a sequence of geometric actions. So for instance the action “draw a circle” is denoted by a square with a circle and dot inside it. In order to draw that symbol, we must instruct a browser to draw pixels representing this geometry. We do that by breaking down the construction into actions which can be described in a purely geometric way, without direct reference to numbers. For the symbol for circle, for example, the construction is: move to the right, draw a square, shrink the unit by two, move left and up, draw circle and dot, move down and right, then increase the unit by two. This unit is of course some number of pixels in practice, but the construction uses language independent of the actual value of that unit. This makes our language independent of specific numbers. It is a sequence of discrete geometric transformations, which can be carried out with any physical medium at any scale in any coordinates. This abstraction is incredibly powerful because it means that we can very quickly and easily create a new implementation in any language or format, and transfer a symbol over without changing the code. This is how a symbol designed in a web browser can be converted to a physical thing made in a laser cutter, 3d printer, clay printing robot, spray paint robot or microscopic lithography tool.

The basis for all the discrete geometric actions are scales and symmetries. We do not refer to angles in de-

degrees or distance in pixels, but in rotations and resize operations based on the natural structure of the world. This means we start with fourfold symmetry, fivefold symmetry and sixfold symmetry. Rotations are combined with angle manipulations like doubling or bisecting an angle, or tripling, or dividing by three. This approach uses numbers in any given implementation, and can be used to represent numbers but again is not actually based in numbers. The symbols we use denote actions based on symmetries, rather than any specific reference to angles in numbers. The scaling is based on the symmetries. For example, everything based on the pentagon and pentagram have natural scaling based on the Golden Ratio, which is the ratio of the side of a pentagon to the longer distance between points across the pentagon. The same relationship exists for the hexagon and square root of three scaling, and the 45 degree right triangle and the square root of two. So rather than using numbers to re-scale units, we use these universal scale factors based on symmetry, like “multiply unit by the square root of three” or “divide by the Golden Ratio”.

We use this system of drawing and moving a drawing tool around to create *everything*. This can be used as a replacement for both art and engineering software, creating plans that people can read to build things with their hands. In its most basic form, it is used to manipulate pixels in a web browser using the “canvas” element which is part of the basic standard available in all web browsers

via HTML and JavaScript. We can interact with Geometron with a touch screen, a keyboard, or other hardware interfaces we build based on Arduino. In the touch screen, we work in the web browser as always, and use buttons created out of canvas elements which have events tied to them which control the “Geometron virtual machine”, or GVM, which is part of the code in our system. We can also use a keyboard to control the actions of the GVM by putting the cursor in a text input and writing keystroke events which call our code and do things to the GVM and ultimately symbols in canvas elements. This shows how everything in our system points back to itself. A canvas displays a sequence of symbols, each of which is drawn with a piece of software which replicates with scripts which also run in the browser. This sequence is edited by hitting keys on a keyboard painted with symbols or canvas elements which use the same software to display the symbol of the geometric action in our program. Any sequence of Geometron actions can be called a “glyph”.

A Geometron glyph is a magic symbol in the sense that it replicates itself with human control. We edit the symbols which control all our geometry using symbols made of symbols and so on. All this can happen in a web browser using applications which replicate via the cybermagic system discussed earlier in this work. All the information required to make a GVM for a canvas and edit glyphs is contained in a JavaScript library called

geometron.js, which we replicate and edit as part of our system.

The web library which we use for all the work with canvas elements can also export to the vector graphics format SVG(for Scalable Vector Graphics), as well as the bitmap format PNG(Portable Network Graphics). The icons used as links and buttons in our system are in the SVG format and are all stored in a directory which gets listed and copied using dna.txt and replicator.php in the cybermagic system. These can also be used as technical illustrations and art in books in our system. Collections of these files are in a feed which we generate using web based applications in cybermagic, and these collections are themselves self-replicating sets. Replicator scripts can be run from in a browser on any server which will replicate a set of SVG files from any other server on the entire Internet. This set can then all be edited live in the browser on the new server, and then replicated out to yet another server and so on. This is the power of Geometron Symbol Magic: to have symbols be edited live in any browser on the planet from any server, and then replicated from server to server again and again, evolving freely. Every icon in our system is like this, and can be edited and changed as the system evolves.

These SVG and PNG files are also the basis of physical fabrication. They can be used to create physical objects using laser cutters. This can be done on a wide variety of laser cutters, or they can be uploaded to a

print-on-demand laser cutter service like Ponoko.com or a public library maker space. Laser cutters can cut and etch a huge range of materials, including a lot of waste materials. Cardboard, plastic, sheet metal and wood can all be cut into shapes in a laser cutter. This means we already have a system here by which self-replicating files entirely managed from inside a web browser can create physical objects out of trash! This is trash magic! The SVG file format can also be imported into other software used to control machines which make physical things, like electron beam lithography for making very small electronic circuits or embroidery machines for making textile patterns.

This system of discrete geometric movements and constructions can also be used to construct three dimensional files from a web browser. We use several three dimensional web-based file formats to do this. The same canvas element we use for all our two dimensional graphics editing in the browser also has a three dimensional mode which we can control with Geometron for live editing. The format formerly known as VRML for Virtual Reality Markup Language, is now called x3d, and a Geometron glyph created in the canvas can be exported to this format, which can then be imported into numerous types of 3d software like virtual reality, augmented reality and games. There are also web libraries which export to the STL format used by 3d printers. With these standard file formats we can get from the web browser to numerous

engineering software systems which allow things designed in our system in the browser to turn into physical objects using numerous machines.

When we build our own fabrication machines from trash, we control them all using the open source hardware platform Arduino(for now). In order to be able to do all programming from the browser, our system includes the ability to generate Arduino code from the symbol glyphs we create in the canvas element which is printed in a text area by our software and which can be copy/pasted into the Arduino software to load onto the board without ever having to interact directly with the Arduino code. This makes the machines we build much more accessible to way more people than is ever possible in existing systems of machine control. Rather than learning to control a machine with either low level code made of numbers and broken English or some high level system based on specialized applications for some specific hardware, we allow anyone anywhere on the Internet to create, edit and share the glyphs made up of symbols which determine what a machine will do.

As an example we imagine a machine in which a winch is on a rail moving side to side across the top of the wall of a high rise apartment building. We build a language of symbols which denote “move left one unit”, “move right one unit”, “double unit”, “halve unit”, and so on, all of which display in a canvas element in the browser. These symbols are also painted on keys on a physical keyboard

used to input keystrokes into the browser. A non expert can write a sequence of symbols which create a sequence of physical actions in an intuitive way. Then, if the robot is rebuilt with a totally different motor and control technology, whoever builds the new system only needs to find a way to implement “move right one unit” and so on into the new system and the glyphs written in the old system will work on the new one with no modification.

As our system develops we will replace more and more parts with Geometron, until all of our machines are based on self-replicating symbols, whether they are for communication or fabrication or machines which carry out some other task. Ultimately we will build a system by which symbols are the medium of replication we as humans use to replicate all technology from trash and living material forever. The path into the future of this development will be developed in a later chapter in this work.