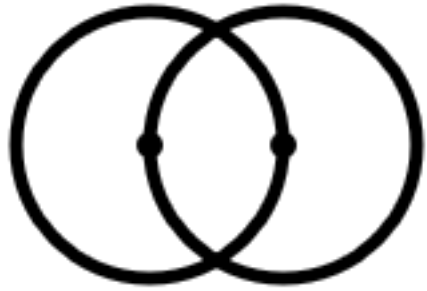
Geometron

Social media for a post-scarcity world

Lafe Spietz



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Chapter 1

Civilizations

The nature of our present civilization is one of constant consumption. We mine or drill material out of the ground, re-shape it or burn it for fuel, and ultimately turn it into toxic which waste we dump back into the environment. During the process from mine to landfill, we exchange "money" and this is what we call the "economy". The things which can be exchanged for money are called "property".

We seek to build a new civilization which is based not on a stream from mine to landfill, but on closed loops of material in equilibrium with living ecosystems. We look to the technological civilizations of indigenous people as an example of what mature technology should look like. In mature civilizations, technology is all self-replicating.

An example of technology in a mature civilization is

traditional wooden boats. If people live in equilibrium with a forest, as old trees die or are harvested new trees grow. People carve logs into boats, and then use them to hunt and sustain their communities. A new generation of humans is born from the old, and they are taught all the skills to copy the construction of the boat, the stewardship and harvesting of the trees, and how to pass along the knowledge of boat building(as well as the hunting and fishing that sustains the whole society) to the next generation after them and so on. Unlike a consumer civilization, this type of self-replicating organic technology can continue in theory indefinitely. If it has the resilience built in to improve and change over time in response to changes in the ecosystem it can truly sustain itself without limits. Mature civilizations like this have existed for thousands of years all over the Earth.

Three things to note about a technology such as the one described above: everything replicates, everything can be modified, and everything dies. Every wood boat will rot, and eventually become soil again in the forest which will produce more trees. The technology is soft enough that people can modify it, carve and repair it over time, change it as needed, and evolve it as needed in response to changing conditions in the environment or new innovations in the technology. And of course, every boat can always be copied freely. In this context the idea of property doesn't make sense. Nothing is permanent. Everything is constantly going through a cycle from soil

to tree to boat to soil again, growing, evolving dying, and being reborn.

When we build an economic system based on self-replicating geometric constructions from trash and organic material, money becomes a completely unusable system. To illustrate this, we consider a very simple thought experiment. Suppose I take a pile of trash and transform that into a robot which builds more robots out of trash, and which has media encoded in it which instructs others in how to copy the whole thing. If I and 100 people go from trash pile to trash pile and run the replication, converting all trash piles into trash-fed robot factories, we have created an ever expanding amount of value, with no property or mined materials going in. A vast amount of economic activity is being created, but without a central bank we have no way to denote all this added value. And if we somehow created a mechanism with some innovative new banking system to create enough currency to represent the added value, the instant we went and replicated the system again we would find that again, the numerical currency system breaks down, as it fails to keep up with the replication of value.

This contradiction is precisely the situation we currently find ourselves in. A small fraction of the population, namely the software industry, the media industry and the finance industry, can use replication to create value from nothing. With billions of people having already bought smart phones or other networked devices,

there is zero marginal cost to add some useful new feature. So when an app goes from running on just a single developer's computer to a whole software team to a beta test group to early adopters and ultimately to a billion smart phone users, this is replication of information, not actual production in the sense of a factory. Meanwhile, everyone else, who are compensated for labor or some type of physical material have to directly produce value to get money. As long as some people create value which freely replicates and others do not, with a finite money supply, over time a larger and larger fraction of money will always flow to the replicators rather than the people doing labor.

There is no way out of this trap. Not a new banking system, not a better government policy. The trap is the numerical aspect of money itself. No matter how fast a hypothetical banking system prints money and pushes it out into the economy, a fully networked replication-based society can create value faster, and continue to amplify the inequality until all value flows to the replicators. We have seen this during the 2020-2021 COVID-19 pandemic in the United States. The government poured trillions of dollars into "the economy" and at least half of it appears to have gone directly into the personal fortunes of people in the replication-based segments of the system. While these people also engage in massive exploitation of labor, this is beside the point. Labor can fight back and win some concessions from the capitalists, but as time passes,

the power will always slip away as the replication rate of pure information-based value increases.

Some people have proposed universal basic income as the solution. This is especially popular with the group of people who have benefited the most from the current accelerating inequality: software engineers and their collaborators in the professional classes. In this system, the software people are allowed to accumulate unlimited and ever-accelerating wealth, and simply paying out money directly to everyone else will help the rest of humanity survive. But if a software person is making 1 million dollars a year, do you really want a 2k/month UBI? How about 5k/month? or 10k/month... but now the software people make $1 million/month? Is that really a working economy? If this sounds insane, look at what is happening to rents, look at who all the new housing is built for. This is happening now, but without any UBI to soften the blow, and it will continue to happen as long as we all cling to this failing economic model.

So what is the alternative? The alternative is a switch from an arithmetic to a geometric economy. This means that rather than an economy of exchange, where numbers are used to represent both property and labor, we have an economy of replication of geometric constructions. In this situation, the replication of information *is* the economy. It does not turn into numbers at any point. One can create a thing via a geometric construction from trash which contains information for its own replication. This then

replicates out into the human network in a replication-based future descendant of the current Internet, and we all share the increased value. When we create value we do not "trade" it for something, because the amount of value will *increase* as it replicates, making any trade that truly represents the added value impossible. In a post-scarcity trash-sourced geometric economy, everyone benefits from the creation of creators because the best things naturally replicate to all of humanity, including the back to the creators themselves, but now amplified by the added benefit of billions of people potentially improving it.

The Geometron/Trash Robot system is an attempt to build an information technology system which serves this purpose: to build a purely geometric economy based on replication. In this system, everything replicates, everything evolves, and everything can be deleted at any time. In the beginning we source some parts from trash and some parts from common off the shelf consumer items that are easy to buy without any centralized company. In order to replicate successfully, however, this information networking system has to provide immediate value to the user, both within the existing money-based economy, and also outside that system.

In order for all this to work, we have to give up the three main elements of our existing system: mining, money, and property. As long as money exists, replication will break the economy. As long as mining exists, we will continue on a path to total destruction of the

world and eventually scarcity and extinction. And as long as property exists, replication which could end all scarcity for all of humanity will be hindered by the people who control everything. The extension of property into the domain of pure information is another major reason that people in the replication industries have been able to so brutally exploit the rest of humanity. They claim to "own" most of the freely replicating information we rely on in the new economy, and they're effectively landlords who can create new land as many times as they want for free, but then can charge rent on all of it. Only by creating a new economic model from scratch which simultaneously abandons money, mining and property, can we build a just and sustainable future.

It is not immediately obvious that geometry can completely replace numbers-based thinking. But in most cases, our technology is already completely driven by geometry, we just choose not to look at it that way. What is a microchip? It is a geometric design imprinted in silicon. That design is made by a geometric program interacted with by a user thinking geometrically. Even the code itself, encoding into the physical circuits, is a geometric pattern of either magnetic or electric perturbations of physical objects. And "computers" are not used primarily to compute things, but to display graphical information, both text and pictures and graphics. The repeated actions of automation machinery represent geometric operations(e.e. move over, move up, move down, move over,

etc. . .)

Saying "geometric economy" sounds abstract and to say it self-replicates sounds far fetched, but none of this is a new idea. Many of the oldest and most sustainable civilizations in the world have very very old technologies involving textiles made from natural materials woven into patterns. This is self-replicating geometry. It satisfies all the properties listed here: it dies of natural decay, is taught as a skill from the old to the young and is constantly replaced, and it can be modified and improved over time by the constantly-replicating group of experts in the technology within the community. So the transition to a geometric economy is not to some futuristic new idea but a return to ideas which predate the rise of industrial societies and nation-states.

All that said, we live in times different from any which came before. The Internet is the baseline information system now for all of humanity. Even the few people not connected to the Internet now have their lives completely molded by it, as all power networks exist on it now. And consumer society has injected every single element or type of finished product our civilization uses all over the planet. So while in times before now one group of people might discover the use of bronze and another of steel, now every single person on the planet can get aluminum sheet metal, titanium reinforced steel, rare earth metals, ultra high purity silicon, etc. All these incredible materials, already shaped and processed into the most

useful form, are simply sitting in piles of trash in every corner of every nation on the planet now, all directly adjacent to nodes on an information network which connects to every other part of the planet.

This combination of universal networking and universal access to identical, standardized, trash elements creates a formula for building a new information system from scratch from which a whole stream of new civilizations can rise. It is our task to build a seed from which such civilizations can be built. Geometron is an attempt to build this seed.

Chapter 2

Organic Media

`index.html`

2.1 Organic Media

- everything replicates
- everything evolves
- everything dies
- no money
- no mining
- no property

Organic media exist to replicate that which we desire to replicate. Its purpose is to facility replication of things. It contains both information on how to replicate things and information required to inspire people to *desire* to carry out replication. We must give people a reason to replicate as well as a means to replicate. Thus one form of Organic Media is instructions on how to build something you can sell. To maximize replication we are less concerned with how much money someone can make via replication than we are with how little they have to spend to initiate replication. We want to minimize the cost of each item a person might buy to sell, the minimum number required to be purchased, and also minimize the amount of labor and skill required to make the thing. The ArtBox is an example: each box contains the content to make another box. Each box is awesome and can be sold. The ArtBox itself is Organic media. a bunch of SRS gets moved here.

path of replication: how to install and how to teach others to install, how to replicate the code, replicate specific files, how it's all structured, editing the code itself

the structure of sign pointing to domain which points to terminal which is near a place which is labelled by domain(this needs to get explained early since it will be the referenced in everything, as it's basic to the structure of the System)

Editing: how files work, how they don't work. No databases. no private data. No file that cannot be edited.

Deletion: cheap sd cards can be wiped any time. All files can be deleted or written over by anyone at any time. Domains are chosen to be of no real value, are disposed of as soon as burned, never sold. Evaluate entropy of domain names to prove we can always have zero value of names even as our network grows exponentially. "Permanent" deletion less critical in a world without private or personal data.

Cybersecurity: there is none. Security is for private property, and there simply is none on this network. This network must always be disconnected from the property-based Internet or private systems. One way paths of information for protection.

draw from the SRS paper and the existing organic media paper(but the formal SRS idea goes in ontology chapter)

File types independent of technology: symbols, feeds, maps, scrolls. These can be described without any specific implementation of *either* software *or* hardware. Specific implementations will be dealt with in their own sections.

How files are structured, overview of file types, what they do. All of this is as a generalized specification which users can use to rewrite from scratch quickly.

Example of physical organic media: The Art Box, replicator card, replicator shape, object itself, scroll

We will return to the Art Box again and again as we go through the system, illustrating how it can replicate in

the Geometron system and how it fits into all the parts: symbols in "symbols" for the shapes and net, the set in ontology, maps, feeds, scrolls, scroll replicator, role in magic as one of the Trash Robot avatar objects

The user page, basic operation of Geometron as it exists today, just viewing now editing, but with pointers to editors, jump on and look at a file RIGHT NOW, on one of my pages.

In organic media chapter we introduce geometron and say what we're going to be doing in this book. What we are doing is providing a *specification* and an *example* of an instance of that spec. We will use the Pi, and remote hosted pages. But expect this spec to be used by many coders on many platforms in many ways if successful.

This is the chapter which defines Geometron, states the goal here. We want an information network which facilitates the free replication of technology built from trash. To do that, we will need text documents, hypertext graphical documents(like slides), feeds of information elements, and generalized symbols and symbolic languages which can be used to create vector graphics and control machines for automation. Creating this language and a hardware platform to transmit it, which replicates itself will be a seed of a new economic system. In order for this to self-replicate we need the media to create value for its users. The next section describes the physical network which our system runs on.

In this work, we describe a system called Trash Robot

and a language and IT platform called Geometron which together can serve as a platform for a post-scarcity economy without money. We will describe how the symbolic language can be used to create automation technology from scavenged trash components, and demonstrate with a practical machine which itself is used to fabricate materials which can then be sold.

Chapter 3

Street Network

3.1 Street Network

outline:

- what and Why? The power of the physical, local, and free. Organic media, what we want, links to previous chapter. Universal social media for sharing of information in a physically local domain with both content creation and consumption on all Web-enabled devices(laptops, phones, tablets, etc.) Hybrid markets: like Craigslist, but way more local. General description of what the system does(scrolls,maps, feeds, symbols, apps, industrial design and production via Trash Robot). This points to the subsequent chapters about these actual things. Free

boxes and food not bombs. We are a hybrid between free boxes and food not bombs and craigslist.

- The Terminal. This is the heart of this system. What is the Raspberry Pi, why is it powerful? How to build the Terminal. Options involving big screens and projectors, public terminals with large publicly viewable displays. How to adapt it to different situations, how to work with wifi networks, IP addresses, local and global, opening up a local wifi to a public domain. how to avoid ANY property. How the terminal is passed from user to user to operator to operator. Data hygiene: how to keep all personal information of any kind of the machine, to prevent leaks of property. What it means to have a network without property. Replication paths via local laptops(localhost) on wifi, global github repos, replication to global hosted domains. How to constantly back up and replicate to avoid information death. How to kill bad information. How to nuke the whole system if it's too rotten. Grey market and black market commerce.

- The Operators, what we are, what we do, how we do it, how we make money and barter, how we train new Operators . Role of Operator as universal moderator. Forking and avoiding the trap of the network monopolist. How to transition be-

tween money to barter, how to scale up to an all barter system by providing value for

- Psychogeography. Nodes of power, examples at global level and local level, finding the nodal points. Go through the whole philosophy, places, examples such as: parks, intersections, neighborhoods, famous landmarks, bridges, forking below a place, discussion of distance scales and granularity. Targeting nodes of power: Sand Hill Road. Wall Street. SoMa. K Street DC. Jackson Hole. Martha's Vinyard. Navy Memorial DC. Use of power nodes to build extremely powerful local networks, where information is exchanged between players in existing power networks. A network in the right coffee shop could connect people who collectively are processing 10's of billions of dollars of commerce just in that one coffee shop!

- domains. choosing domains, buying them, sharing them, avoiding troubles. Entropy of domain choice, size of name space. use of free web hosting services. Signs, markers, stencils, postcards: physical media which points to domains which point to terminals and link to the IP addresses. The work flow with physical media to software media and back.

- The market

- the coffee shop(or pub) node. How it can build community in the coffee shop, help all coffee shop customers to share and prosper, help neighbors of coffee shop, the developer workflow, use to expand operators. Coffee shop network as service for coffee shop owner for barter for coffee and food at shop. Building collaboration with businesses, both local and global, how to use global chains to scale globally with mutual aid and benefit for all.

- scaling up: the global swarm, going to full stack geometron(see last chapter), building more

What is the Street Network?

We want an information network based around physical replication of technology from trash. To stimulate the replication of the Network, we need it to create value for people who use it and operate it. This value can be of many kinds: it can directly provide physical goods people need, it can facilitate business in the monetary economy, it can provide mutual aid to a community, it can create local social connections, can build network power for users, and any of these values can be traded for materials and space needed to continue to expand the network.

Truly free network. The Humble Pi. The power of a network without property or users. Networked tech-

nology with free sharing can create more value for users than one with private data. Destroy the data brokers by making a network with no personal data.

This book will describe several products and services which Operators in the network can provide to local users. These can be exchanged for money or bartered directly for materials to expand the system(for instance one can ask users who are paying for goods or services to simply buy more computer equipment to build out more network infrastructure.) We aim to have the goods sold be as much as possible based on a stream of trash which are upcycled into sellable products. The prototype product here is a purse, the ArtBox, which can be constructed using the methods of Geometron and which contains the tools to replicate itself. It is, in essence, a self-replicating purse with a unique Open Brand, the Trash Robot Brand, which will be documented in its own chapter.

Services rendered will generally be of the kind which makes money for the user. So for instance a passerby might place an advertisement on a news scroll for a local coffee shop for their service which other coffee shop customers(this is all over the wifi network of the coffee shop so everyone is indeed a customer) might want. This makes the user money, which motivates them to come back and place more ads, so they are making money which they can pay to the Operator. All of this commerce then motivates people to come into the coffee shop and read and share documents. Since wifi has a time limit

and requires purchase, this brings higher traffic to the coffee shop, which then has their revenue go up, so to keep the system running, it is worth it to them to barter snacks and coffee to the Operator of the network.

Structure and purpose of the network: domains, places, operators, mutual aid, markets,

Networks are advertised with physical media which points to domains which point to physical places, specifically to the location of the physical web server, and have a hyperlink which only works on the local wifi network which links to the web server on that network.

The Street Network is social media based around physically local instances of the Web which are not on the public Internet. Wifi networks are used to share documents locally with other users on the same network. The Geometron servers function as public bulletin boards, where documents are shared freely with all other users. Any user can edit or delete any file. All files can be copied by anyone. Documents are all visible by both mobile devices and computers, as long as they are on the same wifi network. The Street Network is an example of Organic Media. It is intended to facilitate replication by users. Users can create and share documents advertising whatever commerce they wish to engage in: they can sell things, share ideas, give things away for free, advertise services, advertise businesses, describe how to make things, or look for others with shared interests. There are no users and no databases. There is just a list of

documents which users can click on to read, edit using the editors or delete using the file deletion tools.

The Geometron documents are stored on a Geometron Terminal, which is based on the Raspberry Pi mini-computer. Raspberry Pi is a non profit project from the UK to create a minimalist Linux based computer, mostly for education, research, art, and maker hobbies. They can be purchased easily online for approximately 50 US Dollars. The two most widely used formats of Geometron documents are the Scroll and the Map. A scroll is just a text file, with some formatting in a markup language called Markdown.

Add paragraph somewhere on role of cryptography in sharing encrypted plain text copy/pastable files. add functionality. PGP? ask someone for help on this section to get it right. How does this all work with various crypto technologies? free sharing of encrypted files which can be replicated but then decrypted privately. This can be a huge vector of replication for the crypto community, including inside the formal and informal intelligence community.

Edit scrolls.

Edit maps.

feeds. using feeds.

Workflow, developers, apps. reference code structure chapter. Coffee shop developer community.

use cases

Traveling kids, hobos, panhandlers, people asking for money on the street corner. A physically local free bulletin board shared by passerby in a high traffic area can allow people asking for money who are currently ignored by passerby as just another anonymous face and cardboard sign a chance to really tell their stories and to share all that they have to share. When people share their stories they can become part of the emergent physical community of passerby in a location where the network node is located. When people view others as part of their community they not only are more willing to help, they can have open communication about the best way to help, expanding from just spare change to more comprehensive mutual aid. Because we clone content from the local terminal to web pages on globally visible domains linked to a physical place, which are advertised everywhere in that place, marginalized people whose only ability to get online is the public library can use the computers there to get the information they need to better survive, and ultimately to thrive and build new communities where they already are. The way a local network can help people is twofold. First, it is direct, by asking for money and other mutual aid. But by being physically on location all the time, already with physical media(cardboard signs), people in a given place can aid the network, creating value for the other people in the community who

are more resourced, who then no longer view monetary support as "donation", but rather as an expense which supports their other business activities.

In order to see the power of this second means of network support of marginalized people on the street, we have to look more closely at the network nodes we are building. One of the major types of node is in a business district of a city where there are both homeless people asking for money, on the street all day with physical media, and power brokers who make their living entirely from connections. These people include venture capitalists, entrepreneurs, lobbyists, consultants, and the rest of what might be called the "deal-making class". An example of this confluence is some of the parks along K-Street in Washington DC. K Street and adjacent streets is home to a huge homeless population as well as power brokers whose livelihood depends entirely on connections. If a physical network were built which facilitated direct communication between people along K Street,

The elements of traveler culture which overlap with "van life" are also key to increasing the network effects of the Street Network. This also links to trucker networks. People who live their lives on the road can use this network infrastructure to set up complex networks and markets in highway rest stops, Walmart parking lots etc. using either wifi networks in these places. These networks can be of utility to passerby of all kinds, from tourists to truckers to the workers who keep the places

running. Just as existing global social media networks provide value they can charge money for, a physically local network can provide value which people will pay for. An example use case here is a Street Network Operator agreeing to maintain a backup of and keep posting an advertisement for something a local entrepreneur is trying to sell to truckers. In exchange for that, they can get directly compensated in gas, right there in the rest stop, without money changing hands.

Food not bombs, street outreach, harm reduction people, mutual aid workers. See above. The people who are working to help the most marginalized members of any given community can better reach that community if there is a physically local media platform where people can share information about resources. Documents can be posted which explain how to get access to resources, when and where resources will be available, etc. Because the whole system self-replicates, as with Food Not Bombs, anything which is successful in any given place can be immediately cloned to other nodes on the network. Food Not Bombs already has a global network of free and open nodes with no property but a very recognizable brand identity and set of behaviors and actions. FNB nodes are generally already linked by networks both online and via people who travel from one punk house or FNB house to the next. The whole anarchist network of community houses, FNB's, anarchist infoshops and bookstores, really really free markets, free boxes, etc. can form

a basis for a truly free information network carried from house to house and city to city, running on house wifi networks.

Coffee shop owners. Building a network in a coffee shop on the wifi network which requires purchase to use and which has a time limit can create a huge amount of added business for any local business owner. It also builds community. So coffee shop owners who find themselves with a full shop of laptop drones with headphones on who work for hours, or get kicked out and do the same thing somewhere else can instead find themselves the brokers in a very powerful information network. Much of the commerce of the world is now code written in coffee shops on laptops. Creating physically local networks around these already existing groups can create huge power for the users which then benefits the people who set up the infrastructure(again, just like existing centralized social media platforms.)

Developers. We need developers to be constantly writing more and better software in order to make Geometron a success. Developers who work all day in coffee shops or any other shared space like a co-working space or pub can have a social network based on both co-developing applications useful to all and sharing other resources. Developers will use the resource of the Street Network terminal/server on the local network in the same basic way as others: they can share their resumes, links to pages of personal projects,

Power brokers. Venture capitalists, financiers, entrepreneurs, deal-makers of all kinds, lobbyists, politicians. Your network is your power. Geography matters. Build a network in the lobby. Post things on street nodes, build your network, build your power, build your literal street cred.

Crafters, makers, jewelers, artists. An alternative to Etsy, street vending, or being in a shop. Post your stuff to the local networks. This is much more free and long form than existing platforms, you can post images, descriptions, contact info, times and places when you'll be in a place. This can be way easier than other sales channels for arts and crafts. You can say when and where you'll be at a place, post a link for contact, and then show up in the network node like a coffee shop to make the physical exchange. In many cases, because the network is physical and local, there will be barter opportunities as well as direct sales. A barter economy can develop where people donate materials you use for your crafts as part of how they pay for the finished product. Removing shipping or transport costs by dealing directly in a physical location removes friction from the market, amplifying dramatically the power of the market, especially for crafts which involve physically bulky objects. For instance, people can bring in motors and properly prepared plastic sheets and cardboard, as well as rolls and rolls of duct tape, and we can exchange finished products built from these materials and tools, as well as free food, drinks, and sup-

plies, creating a market economy without money as well as without formal business structures(making it easier for marginalized people to participate).

Trash Robot. Trash robot will be described later in this work. It is a system of technology which can be used to build products from a combination of waste streams and consumer off the shelf(COTS) products, which has a clearly recognizable brand identity owned by no one and provides value to an end consumer. Trash Robot is a meta-business: a system for people to build businesses which can use both barter and sales to make money on the Geometron Street Network, further facilitating the replication of that network. If the right people start doing Trash Robot on the Network, we can create a system which has a significant consumer demand. Trash Robot is structured to be very easy to replicate for an individual but very hard to replicate for a for profit centralized technology company driven by building up value in their equity. This means if we can build up a significant consumer demand, it will provide a very powerful stimulus to replicating the nodes to grow our network, always as a free decentralized system. Building a thing that replicates faster than property that is not property is how we start building a society without property. This is described in detail it its own chapter later in this book.

Building the Geometron Terminal/Server

These should be called servers because they're servers.

Buy the stuff:

- Raspberry Pi 4 board from Sunfounder
- SD card
- SD card reader
- Mini USB keyboard(without number pad)
- mouse
- Sunfounder HDMI display with 12 volt power supply and USB power out to drive PI, wall plug and HDMI cable, or similar display which can run off of a 12 volt barrel connector with a USB power output to drive the Pi.
- 12 V LiPo battery pack with wall plug charger from TalentCell(sold via amazon)
- wifi hotspot

Put it together. Just assemble the Sunfounder terminal as per the instructions.

If you have a display that does not have a mount for the Pi, build an integrated terminal with cardboard, duct tape, and plastic HDPE sheet from milk bottles.

Burn the card with NOOBS, put it in the Pi.

Use paint pens to put symbols on keyboard.

plug in mouse and keyboard.

Make a bag to carry the terminal around in, or find an appropriate backpack and sew symbol onto it. Symbol of Raspberry Pi using Penrose Tiles.

Boot up the pi, set it up with no password

Install Apache and php

copy the Geometron code replicator script replicator.php into the web directory. THis can be found from any geometron server at [serverurl]/php/replicator.txt.

Learn to use with subsequent chapters of this book, customize and deploy, replicate to other people

run in headless mode, or on big screen, discuss display options, how to deploy in different places

The Operators

Psychogeography

Domains

Street Market

We help people sell stuff directly on the Street, out in the open, with a sign advertising the Market. People can sell for barter. We also sell directly the items from Trash Robot and other Geometron Things described below. These include the ArtBox as a purse, shirts, pants, flags, bags, clay icon tokens, robots, terminals, laser cut acrylic shapes and rulers and protractors, Pyramids,

Coffee Shops and Pubs

Scaling Up

Street Network:

- operators
- terminals
- domains
- streets
- places
- developers
- signs

- postcards
- markets
- feeds
- scrolls
- maps
- pages
-

The Terminal is a Raspberry Pi with a keyboard, mouse, display and power supply, which run a web server only visible over the local wifi network. It is carried by the Operator, who uses it to help users create, edit, copy, and share files over the local network.

The files on the Network can be: - Scrolls. These are a type of text file which uses the Markdown markup language for formatting.
- Feeds. Feeds are either a directory with a sequence of files a user can scroll through and select or an array of any kind of information, be it images, symbols, words, links, etc. - Maps. A map is a sort of generalized meme, like a PowerPoint or Keynote slide. It is an array of elements each of which has a position, angle, width, possibly an image url, some text, and possibly a link destination, which might be either a HTML hyperlink or an internal link to a file on the system

All users on the same wifi network as the Terminal can view, edit, delete, and copy all the files on the system.

There are no user names, no logins, no passwords, no private data, and no databases.

Users can all see all files, edit them, delete them, copy/paste them, create new ones

Operators carry the Terminal around, share its link with people, talk to people about the system, teach users to use the system, help to share with new Operators.

Roles of the Operator:

- the keeper of the physical Terminal
- maintain relationships with users of the Terminal and Domain
- update the Geometron server at the hosted Domain with links to the IP address on the local wifi network of the Terminal, as well as the wifi network name and password or link to where to get it(e.g. coffee shop register)
- post ads for money or barter on the Geometron server at the hosted Domain for people who ask
- post on the global Geometron server when and where the Operator will appear, or where the terminal is set up on what network if it's installed permanently.
- Teach anyone who wants to learn how to be an Operator, recruit new Operators
- Tell new users about the Network, teach them to use it, how to post, edit, delete
- Promote any kind of business or other venture or project anyone physically local to the wifi network

area has in exchange for barter with that user for useful things on location(including just a place to operate)

- Spread Network into new places by finding a location with a wifi network, buying a domain and setting up hosting or getting someone to do that and pay for it,
- Domain names spread in physical space using physical media with depiction of domain which points back to terminal ip address, wifi address and password, photo of terminal and operator other physical media(post cards, book marks, spray paint stencils), spreading the physical media with the domain name

Skills of Operator

Domains

Terminals

Laptops

get ubuntu working under windows, install apache and php

localhost

code goes from terminal to laptop to github to

Chapter 4

Code

home

4.1 Code

This chapter is for you to learn how to become a Geometron Developer. To do this you will first need to learn the basics of Web Development. I strongly encourage you to learn how I did(unless you are already a web developer). You need to learn the basics of HTML, CSS, JavaScript, and PHP. I learned these from https://www.w3schools.co I had to learn using Microsoft Visual Studio Code, because I did not have an editor yet(I needed to learn to make web code to make web code to make web code.) But you will be able to entirely learn all material on all

four of those languages using the code editor built into each Geometron instance and testing instantly on the same instance.

Philosophy

All our code of all kinds is organic media as described in previous chapters.

All code can be copied by all users. All code is human readable, and can be copied by copy/paste. All code can be edited on all servers by all users. All code can be deleted by all users on all servers. No native code. All code is run from a browser, and can be run from any browser on the local network. All code is part of a server which can be replicated as a block with a single operating, copying all files from any computer on a local network to any other computer on that network. Each instance of the code is totally self-contained, and can be edited and replicated to create a new node with no relations of any kind with any other node. A single Raspberry Pi could be used to replicate a server to a laptop on a coffee shop which pushes the code to a public git repository which is then replicated to a globally visible url, which replicates to more computers, git repos, terminals, and servers, and so on, replicating a single instance to the whole world of billions of devices in a matter of minutes if the relations between network nodes are set up properly, all with no centralized structure of any kind.

This system does not have "users" in the sense that they exist in current information technology systems. The systems just *are*. Think of them like any other appliance outside of information technology. We will illustrate the idea of a commonly shared thing with an example.

When you go into a coffee shop, the counter where orders come out and are picked up by customers does not have divisions by property. Customers are not assigned a special area on the counter to the exclusion of others. Likewise the baristas do not have zones marked off that are theirs, with some complex system for assigning a space over from barista to customer(like the driver and rider in a ride sharing app). Instead, the counter is a shared resource: its value to customer and barista alike is maximized by it being a common space where cups of coffee appear and are taken based on whatever is most convenient at the moment. Sometimes someone breaks the model here, and throws a huge dirty backpack on the counter or spills something sticky everywhere, putting the system out of use. But again we all accept that the risk of this and the added work to correct it is outweighed by the benefit of the counter being an open space.

Our information systems in Geometron are like the counter top in a coffee shop. Indeed, one of the primary use cases is to have the software run on a server literally sitting on the counter of a coffee shop. As with the counter, the benefit to customers, workers, and owners of the coffee shop is such that it simply has more value

shared with no property than it would if there were *any* barriers to the flow of information. Anyone with any experience designing and building information technology systems will need to constantly remind themselves how different a model this is to any existing system. Even anonymous message boards are not structured this way. Users are still users, even if they're just an anonymized IP address. In our model there *simply are no users!!* No users means no passwords. It also means there are no "transactions" involving money or property, as any application which actually does commerce can't function without a user on each side of the transaction. Our media can *enable* all kinds of commercial transactions! People can post things which say how to get ahold of them, or link to pages with more specific content some of which might be private. But the point is that something like an advertisement for some good or service on a local network is worth more the more people see it. If members of a community are all posting to each other and all getting value from seeing those posts, it is in everyone's best interest to have things be as free as possible, and this means no users.

Without users, there are also no passwords, no databases, and no "security" of any kind. Security is physical in a physical space, and our networks are physically local and not on the open Internet. In order for this to work, people need to not put any private information on the network, ever. The only way users on their private devices interact

with Geometron is through their web browser.

All that said, encryption can be used in interesting ways in a free open physically local network node. Files can be encrypted in a human-readable format, dropped on a server, and copied out across the web from server to server and laptop to laptop. One can think of numerous applications for this. In the initial version of Geometron that is being released with this book, there are no built in cryptography technologies of any kind. But with the application development workflow described in this work users can easily build that tech in whatever direction they choose. Again, this is the power of a fully open system: you can sit in a coffee shop anonymously editing code, write a totally new kind of cryptography application, share with other users in the coffee shop, who then copy to github and share with the world, and in no time your application has spread to the whole world, untraceable to you, and with others forking the code, riffing on it and improving it. Your project shared with one person on a coffee shop can come back to you in the form of a vast new ecosystem of derived code, shared freely across the global network and finally back to your coffee shop.

Structure

All Geometron apps run in a web browser and so are composed of HTML, CSS and JavaScript. PHP scripts are used to communicate between the web browser and

the file system on the server(even if it is just a localhost server on a laptop).

Each instance of Geometron has a standard file structure where various types of files are always stored. Whatever directory on the web server a Geometron instance is in can have subdirectories which also have yet another Geometron instance. We aim to have the whole system be well under 10 megabytes, so a 1 gigabyte storage capacity server can host a hundred instances easily, each in its own subdirectory. All Geometron applications are html files which sit in the root directory of that instance(although this might be a subdirectory on a server). JavaScript libraries are stored in the directory jscode/ as .js files. Symbol files or other image files used as icons and graphics in a Geometron server can be stored in the directory iconsymbols/. Scrolls are markdown files, which are stored in the directory scrolls/. JSON data for most applications is stored in the directory data/, and are always stored with the extension .txt so that they can be read as raw text in a web browser. The files in the specific JSON format called the "Geometron Map", documented in a later chapter, are all stored in the directory maps/. Two copies of all the php scripts exist on each server. One copy is in the directory php/ and has the file extension .txt. The other identical copies of the files are in the root directory of the Geometron instance and have the file extension .php. In other words each php script has one copy which anyone can read in a web

browser and copy/paste without running the code and another which is exectuable but not human readable.

All these files of the above type are listed in a file called dna.txt which is stored in the data/ directory along with other JSON files. A script called replicator.php has in it a url of a dna.txt file. Replicator.php will extract the root directory of the Geometron instance being copied from the global url of that dna.txt file, and use that along with the JSON data in dna.txt to copy each individual file from the source server to the destination server. Any server can copy from any other server with this. Any given replicator script can have the one line of code changed which points to a different dna.txt file to switch the source server from which Geometron is replicated. So in a complex network, any node can copy from any other node, replicating the whole structure. Note that replication is a destructive process, and in general the server onto which the code is replicated then has all the old files deleted automatically. All information is thus volatile. Anything can instantly be destroyed or instantly be copied an infinite number of times.

If you want to get the replicator on any given server, point your browser to [the main url of the server]/php/replicator.txt. Copy and paste that into a new file called replicator.php, and put that in the web directory of a new server. Then if you just point a browser to [address of server]/replicator.php, and wait until there is a link to click on and you'll be looking at a new instance of Geometron replicated from

wherever the origin was of the instance you copied the replicator from.

You can try this by looking at the code at for instance http://www.trashrobot.org/php/relicator.txt. Or go find raw code at the main Geometron Thing repository under the username lafelabs, repo name "thing"(`https://www.github.com/lafelabs/thing/`).

To become a Geometron developer you will want to have a laptop which can run a local php web server, as well as a Geometron Terminal as described in the section on the Street Network. The server can also be a Street Network Terminal, but it doesn't have to be, it can be a Raspberry Pi which you install the system on. In other words, any Terminal is a full Geometron server, but a server does not have to be a full terminal. You can just use a headless pi dangling from a USB wall plug, as the author does at home, setting it up once with a tv, then unplugging everything and leaving it on permanently.

When your laptop is on the same wifi network as your server, point your browser to the IP address of the server and you will be looking at that Geometron instance. Now on your laptop you will want to create a new github repository. This can be as generic as a repository called "thing". Make a working copy of the repository in some directory on your computer. Now get some type of linux command line working with php installed. In the root directory of your new project directory, make a new file replicator.php and paste into it the replicator of some

other Geometron instance. At the command line, run replicator.php. This should copy the whole existing code system. Once the replication is completed, still at the command line, type

```
php -S localhost:80
```

And then navigate your browser to http://localhost. From there you can edit documents and code on that instance of Geometron just as you would on a Raspberry Pi based or globally hosted server. When you save that whole system to your github you are then publishing that entire copy of the code there. Now you want to edit the version of replicator.txt on your local server to point to the global url on github which points to your dna.txt. This means for instance with lafelabs/thing the line in replicator.txt which we want to edit is

```
$dnaurl = "https://raw.githubusercontent.com/LafeLabs/t
```

In this line of the code, you will want to replace "LafeLabs" with your Github account name and "thing" with whatever the name of your github repository is(a logical choice might be "geometron"). Once this change is made, that global replicator.txt file which points to that global dna.txt file can be used to replicate your local instance to any other place on the Open Web. This means any other private Raspberry Pi Geometron Terminal on

the Street Network can instantly be running copies of your code, without you paying for bandwidth or building a site of any kind. You can private message people the url of your replicator, and they can all be copying from github to private terminals in coffee shops, truck stops, and public libraries on every continent!

So this is how we replicate the system from a pi server to a local laptop to a global code repo to the whole Web. But how do we actually edit the code?

We use a program called editor.php which is based on the open source JavaScript library Ace.js to edit all code on the system. Editor.php reads the files in the various directories and lists them, color coded by code type. You can just edit live, and as you type the code changes. So watch out!! You can just pound keys and wipe out index.html in a few keystrokes. You can randomly delete one character somewhere or add a random letter in a JavaScript library and catastrophically break the whole system. But no fear!! This is what replication is for!! A corrupted system can be totally wiped out by just running the replicator again, to wipe out the corrupted files. If there are billions of copies of a good app, however, the loss can be be on average negligible.

There is a window in editor.php which lists all the html and also some php files as clickable links. This is how you run another critical replication script, called dnagenerator.php. This script is where the JSON file dna.txt comes from. It scans the directories, looks at all

the .html files, and writes to data/dna.txt on whatever server it is being run on. Any time you make new files of any kind on a server, always run that again.

The next most important script in understanding the system is text2php.php. This script takes all the files in the php/ directory which end in .txt and copies them into the main directory with the extension changed to .php, making them executable. This is why we need two copies of every PHP script: because we can't be editing PHP scripts which are actively running, and we want editor.php to be able to edit every single file on the server including itself! Editor.php, like so many code editors, was largely written in itself. You can use it to edit the file php/editor.txt, then run text2php.php and you'll find the editor has changed!! If you corrupt the editor, you'll probably want to just run the replicator again to wipe and replace the whole system. But this is a very useful first exercise if you're learning to become a Geometron developer, and I strongly encourage you to actually do this, right when you get started. Go into php/editor.txt and change something in the CSS to change something like background color, run the script, and click back to editor.php and you should see your customized editor. You can change themes by referring to the documentation on Ace.js.

Editor.php functions by using two other php scripts: filesaver.php and fileloader.php. When you click on a file to load it into the editor, fileloader.php is engaged

using the XMLHttpRequest object in JavaScript to fetch arbitrary files and load them into the Ace.js editor. As you hit keys when the cursor is in the editor, the file is updated using filesaver.php with every keystroke. Once again, there is no safety net here! If you mess around with the code, it changes instantly.

To create a new file using editor.php you use the question mark to input information to the script, with the field "newfile". For example, to create a new application entitled triangles.html, you would put "editor.php?newfile=triangle.html", and scroll down to the very bottom of the list of files to find your new file. Then just start editing it, and when you want to add it to the geometron instance, click on dnagenerator.php and it will be added to the dna to replicate to the next instance. Also, it will now be linked from editor.php, so when you reload the editor, you can click that link to get to your new app. This also works for other files besides new applications, you just include the directory name with the file, for instance "editor.php?newfile=jscode/newjslib.js".

To create another instance of the full Trash Robot/Geometron system, we copy a program called "replicator.php" into the main web directory of the server. The raw code can be found at either locally on this server at `php/replicator.txt` or globally on the original lafelabs Github "thing" repository at `https://raw.githubusercontent.com/LafeLabs/thing/master/php/replicator.txt`.

We generally run Trash Robot/Geometron in one of

three ways:

1. Run it on a hosted remote server somewhere
2. Run it on a Raspberry Pi and serve it over a local wifi network.
3. Run it locally on a computer we are using for active development

To host it on a remote server, we first buy a domain name representing a local place which is not property: a public street, public park, public body of water name for instance. We always choose obscure domains, do not use .com, and avoid any personal information or names of businesses. Then we pay for hosting service. We find the root directory for web hosting, and create a new file called replicator.php. We copy the code in the replicator into that and save it. Then we point a browser to [your domain name]/replicator.php and wait for the script to copy all the files.

To run it on a Raspberry Pi, after installing the normal Pi software, install Apache and PHP as follows:

Then install the Geometron software type copy/paste these commands into the terminal:

To run on a local laptop as localserver, if you're on a mac, just open a terminal. You can use the "command" button combined with searching for "terminal" to find it, then pin it to the menu bar. On a Windows machine, install Ubuntu under windows. Then as with mac you

can use control-escape to bring up the Start Menu, and type in "ubuntu" and click on it to open a terminal. Once the terminal is open, pin Ubuntu to the task bar for easy use in the future.

In the terminal, you want to type

Or open .bashrc

And copy this line after the last existing line of the file:

And then just hit the letter "s" every time you get to the command line.

When the local PHP server is running you can open a browser on that machine and point it to http://localhost and you will be running the full Trash Robot/Geometron software on that machine. You can use this for purely local interaction where no one in the world can see what you do, and can edit various files which you then paste into other instances of the software, send to other users, or import when other users send you date(scrolls, maps, feeds, symbols).

You can fork the whole software when you run it locally on a laptop by replicating the whole system into a directory which is a Git repository, then pushing the code to a public repository(like on Github) and then replicating the new version of the code to the whole Web by pointing the code in replicator.php which has a url for "dna.txt" to the global url for your dna.txt file. Dna.txt has all the files to copy organized by type. Replicator.txt uses that to figure out what to copy. The DNA is gener-

ated using another PHP script called dnagenerator.php. PHP files are all stored as .txt files in the directory php, and a script called text2php.php copies all of those files to the main web directory and changes the extensions from .txt to .php.

All code is edited with the program `editor.php`. This is a code editor which edits all code directly on the server. This is how all code development works in Trash Robot/Geometron. It is all in the Web Browser. Code formatting is carried out using the free open JavaScript library Ace.js, hosted on Cloudflare CDN at `https://cdnjs.cloudflare.com/ajax/libs/ace/1.2.6/ace.js`. With this we can edit all the HTML, all the JavaScript, all the PHP, the raw Geometron, and various data files. This editor is used to make and edit all kinds of files.

To create a new file we can use "newfile" after editor.php as follows: editor.php?newfile=[filiename]. The file will appear at the very end of the list of files, with the right color coding and syntax highlighting based on the file extension.

A coffee shop-centered community code work flow is now described. A Raspberry Pi sits on the coffee shop wifi network. All users in the shop share in making scrolls, maps, symbols, feeds, pages and apps. Then any user can back all that up to a full new code instance, and push that to their public facing Github page. That copy of replicator.php is the pointed to that copy of dna.txt. The next instance of the software can use the code from

this new replicator.php and it will clone the whole code base of that coffee shop, with no reference at all to the original code. Each fork creates a fully independent copy of the code.

To fork a whole full instance of the software down a level, use `fork.html`. This lets you create new branches with whatever name you want, as well as delete whole branches. Deletion is real!! There are no backups. We prevent data loss with massive redundancy of replication. If all users frequently not only replicate but pass along all information, loss is a normal part of information life cycle and easy deletion is healthy.

There is a standard structure to applications in Geometron. An application generally uses the PHP scripts fileloader.php and filesaver.php via the JavaScript XMLHttpRequest object to edit some data file. That data file is always human readable in the sense that it has some global url which you can navigate a browser to and it will display the text in a way that can be copy/pasted via email, text messages etc. With the specific exceptions of formats specific to Geometron, all data will be in the "data" directory. In general, the format will either be some form of plain text for human consumption or in the JSON format. The actual function of the application is then in completely client-side JavaScript. For our JavaScript libraries We always use either a library which is free and open source and exists on a publicly available CDN or a library which is written by us, in

the Geometron network(and is therefore public domain), and which is replicated from the "jscode" directory by replicator.php by way of dna.txt.

Another element we try to have in all Geometron applications is a text input/output, either an "input" HTML element or a "textarea" HTML element, which can be used to import and export the JSON data. There will generally also be a button to import and a button to export. Whatever other buttons and inputs will be added to manipulate the data, and in general as modifications are made, the JSON file is instantly updated in real time as you go, just like with editor.php. Then, when you press the EXPORT button, the JSON code will appear in the text area or input. You can then copy it to the clipboard of a computer or mobile device, paste into a text message, email, private file, or public pastebin, and share with anyone anywhere, and if they have their own local copy of the same application, they can drop it into the same text window in their browser and hit the IMPORT button to load the same data into their app instance.

Perhaps the simplest Geometron app is the wall.html app. This is just an html page where the whole screen is a text box in which everything you type is saved to the file data/wall.txt. That's all! The HTML code in the body of the document is simply

```
<textarea id = "wall"></textarea>
```

A little bit of CSS code sets the size of the textarea element to take up the whole screen. The function of the app is in a script element and is as follows:

```
wall = "";

var httpc2 = new XMLHttpRequest();
httpc2.onreadystatechange = function() {
    if (this.readyState == 4 && this.status == 200) {
        wall = this.responseText;
        document.getElementById("wall").value = wall;
    }
};

httpc2.open("GET", "fileloader.php?filename=data/wall.txt",
httpc2.send();

document.getElementById("wall").onkeyup = function() {
        wall = this.value;
        var httpc = new XMLHttpRequest();
        var url = "filesaver.php";
        httpc.open("POST", url, true);
        httpc.setRequestHeader("Content-Type", "application
        httpc.send("data="+encodeURIComponent(wall)+"&filen

}
```

This is very simple: keystrokes save the file. If you

want to copy/paste the whole thing, just select all the text and do it, and then you can drop the whole thing into another wall on another Geometron page instance and it can be edited there and shared and copied etc. etc. from Geometron instance to Geometron instance.

Another replicator script which is useful is copy.php. To see the source code, as with all PHP scripts in Geometron, go to any Geometron server and look at php/copy.txt. This program takes as inputs a from and to field and copies a file from one url which can be global or local to a local file location on the server. So for instance to copy wall.html from trashrobot.org to your local raspberry pi, you can navigate a browser on the same local network as the Pi to http://[the pi's IP address]/copy.php?from=https://www.t this is a long URL. But it can be put into a link with a shorter text or an image or icon, so that on a page a user can just click it like a button and they will copy the data/wall.txt file from the one server to the other. If links like this are used to copy a file from one server to the next, decentralized replication can propagate very quickly. Again, we can replicate using this tool from a Pi to a local developer's laptop, to a Github repository, to a public web page, to other local Pi servers all over the world, where the whole process is then repeated again and again. And we can be doing this with *any* file in the whole Geometron system: apps, data, JavaScript libraries, PHP scripts, scrolls, maps, feeds, symbols, all the other formats to be discussed here. And again there

are now owners of any of these documents. They are not saved in a user directory and emailed to another user or shared via app from user to user. They simply are not owned by anyone. They are shared resources to be replicated or destroyed.

We must also address how bad code is dealt with. Not all bad code is from typos. Malicious code or media of a bad nature can be intentionally created. What do we do with bad information? We totally destroy it. Not by simply editing it but by replicating a non-corrupted version, totally annihilating the bad instance. In the most extreme case we step out of the Geometron system and just wipe the whole thing clean and then go back and re-replicate. A Raspberry Pi's whole system lives on a cheap little SD card the size of a fingernail. If you really think it's infected with something so nefarious that you can't deal with it, you can always pull that out and destroy it and put a new one for just a few dollars, without any impact on your overall setup. Our goal in Geometron is not to destroy bad things but to create good things that replicate faster than bad things and destroy them by overwhelming numbers. If a bad thing copies a million times and a good thing copies a billion times, on average we all still win.

Also, data files in the data directory can be directly edited with editor.php, which always gives us yet another way of copy/pasting the raw data, even in cases where some data is hidden in the app, or where there is no

copy/paste input/output window, which might be inconvenient for some apps.

Also Python. And Adruino, but that's just mentioned here and really dealt with in the machine control chapter.

need to talk about fork.html, rdelete, deletefile, deletebranch,

talk about the deleters, how delete works

mathuser.php user.php copydata.php replicatornodata.php dir.php mkdir.php

Chapter 5

Scrolls

Scrolls are the text documents of Trash Robot. Think of this like the Microsoft Word of the Trash Robot ecosystem(with some drastic differences). Scrolls, along with maps, feeds, and symbols, form the basis of the user-facing system of documents which are shared on Geometron. They are used to document the system, to share ideas, post articles, create ads or lists of ads, or really any type of document one can imagine.

The format of scrolls can take some getting used to for people used to, as it is not WYSIWYG(What You See Is What You Get), but rather uses the Markdown language to create formatting with code. One of the first tasks of some enterprising new Trash Robot participant will be to create the fully WYSIWYG version of the scroll editor, but for now this is what we have. Part of the goal here

is to have no documents ever be in a format other than human readable. Even if Markdown is a little awkward to read, a real live human can always read the text and someone with very very basic understanding of code can immediately turn it into fully a formatted document.

Need to address the choice to use a markup language rather than WYSIWYG: harder to use, but easier to copy. Ease of copying is more important than ease of use. Bifurcation of users and Operators allows this to be smooth in spite of increase in difficulty of use.

Symbol for scroll:

Create a scroll

To create a scroll, go to the scroll editor at scrolleditor.html, and enter the name of the new scroll in the input marked "new scroll name". When you do this a blank document should appear with black background and green text(this is easy to change if you find it annoying). Just type out your document if it's just text, hitting enter twice between paragraphs.

For further information on using the Markdown language, see

- the wikipedia page
- the official web page
- The Markdown Guide

The most annoying thing about markdown is putting images in, which you do as follows:

Edit a scroll

To edit an existing scroll in the scroll editor, click on it or enter its name in the new scroll name input(no need for the "scrolls" prefix).

copy a scroll from another place online

All things in Trash Robot self-replicate and scrolls are no exception. To create a replicator we use the program copy.php which is on every TR server. To this scroll is called "scrolls" and to replicate it we make a link to "copy.php?from=[some web address of a trash robot server]/scrolls/scrolls&to=scrolls/scrolls". If you run this on a server it will fetch this scroll and place it locally in the scrolls directory. Of course as with any replication this will overwrite the scroll on the local server so be careful, as any new edits on the new server will be lost.

To copy all the scrolls, as well as maps and other data, from another TR server, we use copydata.php. On whatever server you are on, make a link to "copydata.php?from=[the url of the domain from which you're copying]. Note that for both copy.php and copydata.php the source domain

can be the IP address of a TR server on your local network.

Also, the simplest way to copy a scroll is to open a new scroll on a new server in the scroll editor, then open the scroll to be copied in the scroll editor on the old server, and just select all, copy, and paste to the new one. This functionality is part of why having everything be in a human readable format like Markdown is important.

link to a scroll from a scroll

Links from a scroll to a scroll or from a map to a scroll can be realized in Trash Robot by having the target link be either "scrolls/scrollname" or "maps/mapname", and the code in the TR user page will convert those to local links. E.g. link to terminal scroll. Scrolls can also be linked to globally by using "user.php" with a scroll specified. For example to link to the Terminal scroll on trashrobot.org we link to `https://www.trashrobot.org/user.php?scroll=scrolls/terminal`.

mathuser.php

Delete Scrolls

Everything on every instance of Trash Robot can be deleted quickly and easily and with no backups. When something is deleted it's really gone. Rather than backing things up or saving to "the cloud", in Trash Robot

we replicate what we want to keep and whatever doesn't get replicated will probably eventually be deleted. To get this functionality, we have a delete scroll page called `scrolldelete.html`. To delete, click on a red X. But this is for keeps! Deletion really is deletion. If you see some bad stuff on a server, just delete it. If you want to post stuff and not have it deleted, replicate it to a quiet place where no one will see it where it can get replicated back to a live page later if it's deleted.

Some technical details and use of Math

The basis of the scroll software is the JavaScript library Showdown.js, which is great, and it converts from markdown to html. So scrolls are all in raw markdown but display as html. Use of HTML tags still work as well. By default it's commented out but by editing the code using `editor.php` it is possible to turn math on using the MathJax JavaScript library, making it the same LaTeX-like markdown that is used in markdown elements in Jupyter notebooks. This allows for rapid free self replicating math papers to be created and shared on the Network.

Code structure

Showdown.js, scrolls/*, filesaver.php, fileloader.php, MathJax.js, dir.php, deletefile.php,

LaTeX workflow

address stability issues for large documents, alternative editors

mathuser.php

To convert a scroll to a tex document, copy the scroll into a new directory at the *nix command line. Then create a header and footer text file as follows:

header.txt =

and

footer.txt =

in the new project directory using your favorite text editor. Now be sure you have Pandoc installed, as well as pdflatex, and any stuff that needs to be installed for latex to work.

Now convert the scroll to a .tex file using pandoc as follows:

Then concatenate with header and footer using

And finally compile from text to pdf using

and if there are no errors in the tex code you will have a printable pdf document.

add full work flow to create a book with multiple chapters, this book. Articles. Links to more information. More details on installation and use of latex, workflow with latex editors to finish the project.

Chapter 6

Maps

6.1 Maps

Replication replication replication replication replication replication replication replication

replication replication replication replication replication replication replication

maps are designed for maximum replication of themselves, ease of sharing by text and copy paste. Ease of building apps to use and edit. And they are created to maximize the Geometron user's ability to replicate other technology.

figures:

map editor

Maps are a format in Trash Robot/Geometron which

are a generalized meme. They represent an ordered list of objects, each of which has a position in a rectangular area on the screen. Each element in the ordered array has an x and y position and width all normalized to the size of the square area, as well as an angle in degrees. The other properties each element has are a url for an image if they're an image, HTML text for both if they are not an image and for alt text if they are, and a link destination which can be either a url or a map or scroll link inside the geometron system. Maps can link to scrolls as well as other maps. Also, each element has a Boolean variable "maplinkmode" which is false if it is just a normal HTML link and true if it is a map or scroll link. Maps are all stored in the "`maps/`" sub-directory of each Trash Robot/Geometron instance. They are in JSON format.

Scrolls are all stored in the `scrolls/` directory. Links inside the Geometron system are identified as to whether they are scolls or maps by the full name of the file. For instance one would link to this scroll from anywhere in the system using the name "scrolls/maps" as the destination of either a link in a map element which has maplinkmode set to "true" or in a hyperlink in the markdown format of the Scroll.

Maps are defined with the JavaScript library "mapfactory.js" which is in the "jscode" directory at `jscode/mapfactory.js`.

Maps are created in Javascript by for example in a DIV element called "mainmap" with following code:

Maps are edited using the program `mapeditor.html`. Click on all the things at random to figure out how to use that program. Save often. Copy/paste JSON code from the text area to share maps across the Internet or privately with other users. You can email JSON code, store it, copy it etc, and anyone can import it with a paste into their Geometron instance and save it locally on their server. This generalized meme format replaces both meme making software and PowerPoint as well as a large number of HTML frameworks and formats. It allows for a generalized system for encoding information on an image, which can be critical to documenting self-replicating physical technology. The three pillars of all Geometron/Trash Robot software are the Map, the Scroll, and the Symbols which are created with the Geometron language. This "symbol" is generalized to include those made in all physical media, so that includes things like lab-on-chip fluidic circuits, hybrid upcycled electronic circuits, laser cut shapes etc. Once Geometron is used to encode all human language and all symbols and also all technology, it can drive the hardware which displays maps and scrolls. When all of this lives on fully upcycled hardware, the system if fully metabolized and we can build self-replicating technology that does not have any mining, money, or property, the ultimate goal of Trash Magic.

Deletion

Maps are deleted with `mapdelete.html`. Just click "delete" to delete. Be careful, there is no backup. Also on public servers this might break, as do all file creation and editing functions from time to time. It will work instantly on a Raspbery Pi Terminal.

Replication

When you create a new map, run `dnagenerator.php`, and the next time the whole tree is replicated that map will come along for the ride. To replicate a specific map, find the URL of that map and use copy.php. The syntax is

The "from" url can be anywhere on the Open Web or anywhere visible on the local network. For example, pastebin.com or a raw code link on Github

Map editor Icon Meanings

Go through in detail how to use the editor. Describe the specifications to build a better editor, plead with developers reading the book to write a better one.

Examples

Use cases.

annotated screen shot or image of geographic map. Example of location places on a photo of a tourist map with a DC subway exit map. Example of a screen shot from openstreetmaps.org

Location of a physical object in a photograph of a place, with link to file, page, scroll or map

navigation: simple links to other documents on the local Geometron system as well as to Geometron apps like feeds or symbol programs, and also links to other web pages.

Linking from a global page to a local terminal and vice versa, with photographs of the terminal uploaded to the terminal.

memes. Just regular old memes, but with edit capability and the ability to share

graph theory diagrams using geometron symbols combined with text, use of math via MathJax js library.

more generalized replacement for PowerPoint or Keynote, but free and open and readily replicated. Give example of replicating the whole deck of maps from one server to another using the standard code replication workflow, separate from replication of the whole system.

labels on a physical object to document that object. Labels can be links to further documentation of the object, which themselves have further zoomed in detail photographs of the object. Detailed, hyperlinked fractal documentation of physical objects can really help replicate those objects, which is what our whole system is for.

Geometric memes showing how geometric symbols fit over objects in the environment, connecting physical things to geometric abstractions like the pentagon or hexagon.

conclusions

Summary of use: all our media is designed for free replication. This means that it's easy to find a thing, easy to copy it, and easy to share it. Maps help us to locate things in physical space to share by annotating geographic maps as well as photos of places. They help us replicate technology by rapidly and freely creating documents of details of the object, with links to further documentation of finer and finer elements of the thing until all parts are sufficiently documented to enable replication. By replicating the pitch deck functionality of PowerPoint we further facilitate replication by helping people to communicate stories behind what we do, helping to convince people why they should replicate. Finally, the ability to make memes easily which can be edited and remixed we build a more dynamic social media based on memes than is possible with bitmapped graphics. This enables open brands to become virulent, getting more and more people invested in seeing our projects succeed and again furthering replication.

Chapter 7

Feeds

home

7.1 Feeds

A Feed is a sequence of elements. The elements don't have geometric structure like a Map. They can be text, links, symbols, or any other kind of media. They are generally stored in the "data" directory as JSON format files which end with ".txt" so that they can be read by humans in a browser.

The Feed is a general framework for building formats, but in the basic Trash Robot server we implement a few versions.

Global Image Feed

This is an array of image urls. This is a key component of how Icon Tokens are made. We often start by doing an image search on the Web for some symbol, logo, image, or icon. We then right click the image and "copy image location" to the clipboard. Then we drop the url in the input in the global image feed to add it to the feed. Click the red "x" to delete the image. Image feeds can be exported from the text area, copied, and pasted into the same window of any other Trash Robot, imported and used anywhere on the Network. Since this data is just text it can be sent via text message or email so that feeds can be privately shared. The local image feed is stored at `data/imagefeed.txt`

We can make global image links in this Feed by uploading images to www.imgur.com, then right clicking the image to get the url and putting that url in the image feed. This method is used to document much of the Trash Robot system or for general rapid information sharing.

Link Feed

This is a feed of "links" in a general sense which can be images, links, or just text. They are edited using the "operator screen", which should be in the link feed itself, and can be found at `linkfeededitor.html`. Each

element has three fields: "href", "src", and "text", which are the url the link points to, the image if there is one, and the text. The data are stored on each Trash Robot at `data/linkfeed.txt`. As with the image feed, the whole feed can be copied, pasted, imported and exported using a text area, but in this case it is on the editor screen not the feed display. The input is used to put in urls of other link feed files. These can be anywhere on the Web. This can be used to make anonymous pastebin links which are link feeds which can display on any local Trash Robot without ever posting to a global server, for private exchange of link feeds. f ## Text Feed

The Text Feed is used for a number of Trash Robot applications. In spite of its name, it is not just a feed of text, but consists of three feeds(arrays): "text", "src" and "href". These really are what they sound like, three feeds in one. Users can add links, add images, add text, or delete any of them, and can copy and paste and share and import feeds. Text feed has a number of functions in the Trash Robot/Geometron system. It is used for the Map Editor as a source of links, images, and text which do not need to be entered in a keyboard. It is also used in the Poetry Engine and Duality. These are documented with the poetry engine scroll and duality scroll.

Chaos Feed

Chaos Feed is a user friendly text feed. Type in the input to post. Hit red "x" to delete. Nuke the feed with the explode emoji. Reload with the arrow loop emoji. HTML works, so you can manually enter html for links and images, allowing a link out to be added. Chaos Feed can be set to be the top level of a Trash Robot Server for text feed sharing mayhem and fun. Chaos feeds are stored at `data/chaosfeed.txt`.

Icon Feed

This is a critical feed for the overall system work flow, as it is how we share the Token Icons which are printed into clay. See the workflow map for links to the elements of the process by which these are made. Here again is where the copying, pasting, importing and exporting of feeds is very important. Users can create a whole feed of icons locally on a private server, then send that via private message to other users anywhere in the world, who can then edit on their own private servers, without any data ever leaking to the public Internet, while still having no users and no databases on each individual server.

Symbol Feed

This is not really a feed in the strict sense above, but it behaves like a feed in the user interface. Every time a symbol is saved using `symbol.html` an SVG and PNG file are both created, and these are saved in a directory called `symbolfeed/`. These can be saved locally and then used for anything. The pairs of files are also used when programming the Dremel laser cutter to directly create laser cut acrylic geometry shapes. The SVG files alone, with different layers as different colors are used for the cut and etch layers when making laser cut shapes ordered from Ponoko.com. Clicking on an SVG file also loads it up into `symbol.html`, including the structural JSON information which sets styles and positions of the symbol.

Wall

The Wall is a feed of one element. It is just a text document, stored at `data/wall.txt`, which is edited and read by users. Type to edit. Delete to delete. There are no users, no databases and no logins. Just information freely shared.

Chapter 8

Symbols

Generalized symbols...

this is just an overview chapter of what GVM and hypercube and generalized symbols are, why we care, how they work, survey of the applications, separate from the various applications which all get their own chapters.

generalized symbol as a concept: pixels on screen, architecture, microfabrication, circuit fabrication, CNC, agricultural automation, biomedical automation,

GVM as an idea to address this maximally generalized symbol

Hypercube

detailed Hypercube structure, whole thing, possible extensions

Geometron is a geometric meta-langauge. That is it is a language for building geometric languages, which

is itself expressed entirely through geometry. The three main components of Geometron are the "Geometron Virtual Machine", or GVM, the Geometron Hypercube, and the Cursor.

The cursor is like a "turtle" in other geometry languages such as Logo, it is a collection of global geometric variable which can be acted on. These global variables might be the position of a cursor in an xy plane, of a cube in an xyz space, of a physical robot tool, or of any technology with geometry in it. The geometric actions discussed below are on this abstraction, which can also be thought as a "tool", which in some cases it literally is. However "tool" can be misleading since the state of the cursor is not simply a position but can include variables like "step size" which are abstract and not embodied in the physical state of a physical tool.

The GVM is an abstract "machine" of pure thought which carries out geometric actions. The actions of the GVM are arranged geometrically into two cubes(hence "hypercube") each composed of 8x8x8 cells. Each of these 512 cells has an address based on its geometric location. All addresses start with the number "0", and indexes count up from 0 rather than 1. One cube has addresses from 0 through 0777, and the other has addresses from 01000 through 01777. Each cell in the Hypercube represents either a geometric action or a list of addresses in the hypercube which the GVM will execute in order. The GVM is fed a "glyph" which is a sequence of Hyper-

cube addresses, and it executes the actions in the glyph in order. Some actions are therefore themselves glyphs, which in turn can be composed of sub-glyphs and so on. Infinite loops can easily be created this way.

The zero cube from 0 through 0777 is the "Action Cube", which represents actions themselves we wish to use the GVM for. Each action has a corresponding symbol in the symbol cube or 1 cube from 01000 through 01777, which is a glyph designed to communicate the meaning of the action to a human user.

The Action Cube is divided into layers, which organize the types of information into different categories.

0-07: left open for future use.

010-037: "root magic", or actions which act on the Hypercube itself or the document being used to interact with Geometron.

040-0176: Printable ASCII. These are used to either place a ASCII character on the Word Stack(to be printed using the action at 0365) or to identify the action taken when a key is struck on a keyboard connected to a GVM

0177: do nothing

0200-0217: Fixed shapes, glyphs composed of sequences of actions which are left alone for general use, not edited frequently

0220-0277: General shapes. Glyphs used to create geometric languages such as schematic symbols, graph theory arrows, cross stitch patterns, flow charts etc.

0300-0377: Primary two dimensional geometric actions used on computer screens. These are further broken down into the Action Tablet documented below.

0400-0477: Machine actions. These include manipulation of global machine variables such as step size or speed of movement. They will generally be machine specific although we will document the specific values for the Token Printer below. IN actual Arduino code these are generally mapped to ASCII, as is the set below.

0500-0577: Shapes made up of sequences of actions in the 0400-0477 space. These can also include the entire rest of the Hypercube, and allow for a combination of 2d, 3d, and mechanical actions, so that for instance a cutting tool path can be saved as a 2d image in addition to the direct control of the machine using Arduino.

0600-0677: Shapes made up of sequences of actions in the 0700-0777 space. These can be used to build whole complex languages of three dimensional shapes for 3d printing design as well as VR and AR.

0700-0777: 3d actions. These actions are used to construct three dimensional abstract geometry. Specifically in the Trash Robot Geometron system they are used to build .x3d and .stl files which can be used for VR and 3d printing respectively. Learn more from 3d scroll. Or just try out the system on `voxel.html`.

This arrangement then maps to symbols which have meaning to humans pointing to the actions. Note that for the ASCII values this maps to a font of the printable

ASCII, which can be in any human language. Building more complex human languages like the CJK characters or fractal Arabic calligraphy, we can add whole cubes to the Hypercube. The range of characters between 01040 and 01176 are called a "font".

The software presented here allows us to use Geometron to make computer files in either the vector graphics .svg format or the bitmap format .png of all sizes, styles and shapes, save them, edit them, replicate and share them. These can be used as icons, as symbols in Maps, as figures in Scrolls, as art, or as patterns which can be directly transferred to a laser cutter to create all the laser cut acrylic shapes which are used for the arts and crafts projects presented in this work.

In addition, the software presented here uses the same Hypercube and GVM to create, edit, and replicate 3d files which are saved in .stl for 3d printing or x3d for VR and AR or games.

Perhaps most importantly, however, the software presented here allows us to create generalized symbols using Geometron which use physical machines to make physical matter with the symbols we create in Geometron. Extending the system to more cubes in higher address spaces can allow for a totally generalized methodology for creating geometric languages for any kind of fabrication, media, display or design technology.

Symbols are created using `symbol.html`. One edits a glyph which is displayed in a canvas element on the screen

by either hitting keys which correspond to actions or soft keys on the screen. Another canvas element displays the sequence of symbols corresponding to the actions in the glyph. The arrow and delete keys are used for editing by keyboard, and there are equivalent symbols on the soft key menu.

Glyphs are stored in software as strings formed from sequences of numbers separated by commas. As you edit a glyph the string will change in an input. That string can be copied to the clip board and saved, emailed or text messaged to someone who can paste it in their own Geometron software to copy the symbol.

Actions of symbol.html

Learn to operate Geometron with the Hello Geometron Scroll

read a book ish document of an obsolete version of Geometron in the Book of Geometron here

8.1 Geometron

The purpose of science and technology is maximize the ability of the human mind to interact with our physical environment. As our society becomes increasingly technological, we find that our power in that society is based on our ability to control machines. As machines become increasingly complex, the groups of people able to control them become more and more specialized, and most

people lose more and more control with each new more complex generation of machines. In this work we seek to push back against this trend by building a language for the natural control of machines by people. The intent here is to build not just a language but a linguistic framework which can be used in many context on many technologies for *all* people to wield more control over *all* machines. By gearing the operation of the language directly toward industrial automation machines it is our intent to build a pathway for ordinary people across Humanity to have direct control of the means of industrial production at the local level.

Geometron is a language for humans to control machines using the natural structure of both machine operation and the human mind. We consider three structures to be fundamental to how our minds organize thought which are mirrored in machine operation. Those are:

1. Cataloging or listing of things. One of the most basic things we do when we organize information is make lists of things: the periodic table of elements, the alphabet, the organization of the base 10 number system, division of light into discrete colors, the system of organizing mailing addresses etc. This is a structure mirrored in how modern computers are constructed: information is stored based on an addresses. Addresses in a modern computer also often contain other addresses, direction the operation of

the machine from one point in memory to another. While arbitrarily complex and varied types of information can be stored at a memory address, it is useful in both machine architecture and human language to impose a structure which is universal across many specific elements. For instance, the mailing address format can point to a vast estate, a PO box, an individual, a corporation, etc. but it's useful to have all these under the one unified system of addressing. Another example of this is library call numbers, which map all of human knowledge to a simple string of numbers and letters.

2. Naming of things. Perhaps the most fundamental form of abstract human language is using a word to point to a thing. In particular the ability of the human mind to chain the naming process together is fundamental to human thought. For example, we use names to point to people, but also use the word "person" to point to each individual person. That is, words are used to point from any kind of thing to any other kind of thing. The naming process creates complex networks of relations between things which we use to build up our whole view of the world. As with the cataloging process, this function is mirrored in the architecture of our machines. The languages we use to program machines are constantly using pieces of information, called

variables, which represent some meaning separate from the name of that information. For instance, in commonly used web software to have something called a "shopping cart" which is an abstract thing pointing to a list of things a person plans to buy. In addition to information technology we consider the mappings which take place in machines where something like a pull on a steering wheel can map to a whole sequence of things, from a computer to power steering, to the many machines which respond in concert to such actions. This is not exactly naming, but has a similar structure, where things are mapped to other things.

3. Geometry. In this work we assume that certain types of geometry are fundamental to the structure of both human thought and to how all machines we build operate. Most of the structure of the language presented here is based on either considering geometry which feels natural to the human mind like "left" and "right" and geometry natural to the operation of a machine like "distance between plants" in an agricultural robot or distance between pixels in a display.

The Geometron language uses all three of these elements to construct a geometric meta-language: a language for building languages. The language consists of

geometric *actions* organized according to an addressing system called the Geometron Hypercube. Each action is represented by a symbol which is itself drawn using the actions of Geometron.

In order to build a language that is as natural as possible for people to understand we begin with what geometry we all consider natural and work from there to a specific implementation. The most basic geometric action we consider are movement by one unit in the basic directions "forward", "backward", "left" and "right". These words in human language have meanings which depend on context, and that is how they work in Geometron as well. "Go forward" is a universal message which can be expressed in any human language, and yet its precise meaning depends on several unspoken assumptions. There is an implied direction-state of the speaker or listener. There is also an implied angle from which "left" and "right" deviate from "forward", and an implied unit which one might move. For example if giving driving directions in a city on a grid, we might say "drive 10 blocks forward along the street you're on, turn right, and go 5 blocks, then left and one more block". By abstracting this language we can generalize to something like "10 units forward, 5 units right, 1 unit forward" and this can apply to paces walked, pixels on a screen, or trees in an orchard. That is, the idea of a grid of points which we navigate with simple lefts, rights, forwards, and backs, is a *universal* idea, which does not depend on special

technical knowledge, but which we can expect anyone to understand even without written or technical language. All this also implies that there is a position of the listener/speaker who is depicting this sequence of actions.

To summarize the previous paragraph, we pose that there is a geometric "state" which all humans understand how to manipulate. This state consists of position, orientation, a basic unit like "blocks", "feet", "steps", "football fields" etc, and an implied angle by which we turn(usually 90 degrees unless specified otherwise). We can then create symbols to represent the basic operations of movement of this state as follows:

- go forward 1 unit
- go back 1 unit
- go left 1 unit
- go right 1 unit
- rotate left
- rotate right

We construct symbols for these which get as close as possible to using a universal language which all people will recognize, in this case arrows. These symbols are then:

These symbols are intended to be as universal as possible, avoiding both the selection of a language like English to draw from as well as machine-specific or technical mathematical language. Each of these symbols is itself

made up of geometric actions which will be documented below: changing of scales, rotations by various angles, and natural geometric constructions such as circles, arcs, line segments, and paths of joined segments. We immediately see the power of building a language for creating symbols which is written in itself. Just as human languages contain dictionaries consisting entirely of definitions written in the language being documented, we can create a language of geometric actions built entirely of symbols using those actions.

This is the most fundamental power of the Geometron language: to make arbitrary symbols which can then be used to program all sorts of other more general machine operations. Once we have the ability to make arbitrary symbols, we can immediately use those to construct commands for operating any machine. For example, if we have a simple robot that simply consists of a stage that can be moved in two directions with a tool over the top of it, we can label one with a red arrow and one with a green arrow, select some basic movement unit, say 1/100th of the total span of the stage, and start writing programs by using a sequence of these arrow-motion actions. In this language, a program that moves left on the red direction, then out in the green direction and back might look like this:

This simple concept can be very powerful when combined with direct controls of a machine. A user who starts moving labelled levers to control a machine can immedi-

ately enter a sequence of actions based on the experience of operating that machine to automate a process. This is the level at which automation can be truly controlled by the people of the world, and is a necessary condition for people to ever control their own means of automation.

With the goal in mind of being able to build a universal symbolic language for controlling machines, we may now proceed to documenting how that language is constructed. To reference the introduction here, there are three tools we will use: assigning addresses to things, assigning symbols to actions(in essence a naming of things), and the use of universal geometry of Nature. When we speak of "actions" in Geometron it is useful to have some sort of object which is carrying out those actions. That object is called the "Geometron Virtual Machine", or GVM. Depending on context, the GVM might draw on a computer screen, control a robot, create 3d structures, control the function of buttons and keys, encode writing in human languages and edit the structure of Geoemtron itself. In all cases, each action has a symbol, which is itself just a sequence of actions. Each action has an address which is made up of three numbers, each of which can range from 0 to 7. Types of action are organized by the first of the three numbers(e.g. machine movements vs. 2d geometry vs. 3d actions etc.). This system divides actions up into tablets which have an 8x8 array of "boxes" each of which maps to some kind of geometric action. The 8x8 array is an aesthetically pleasing way to

organize information which pushes the bounds of what is comprehensible to look at for a person while also fitting the convenience of using powers of two for interaction with computers.

Each action address is matched by a symbol address which adds a "1" to the left of the address. All addresses start with a "0" to indicate the format as a Geometron address, and to indicate for computer code that this is a base 8 system. Thus for example if the action for "draw a circle" is at address 0341, the address 01341 will contain the sequence of actions which draws the symbol representing the drawing of a circle. This ability of Geometron to pivot meaning radically based on context mirrors the power of human language in contrast to most computer languages.

The structure of addresses has its own geometry. A stack of 8 tablets, each represented as an 8x8 array makes an 8x8x8 cube. We have two of these cubes, the "action cube" and the "symbol cube". Again while this might seem cumbersome and one can get lost in the details of the exact functions of addresses, this is intended to create large scale structures which anyone can understand: every action is a location in one of two cubes of 8x8x8 cells. Ever action in the symbol cube consists of a sequence of actions which create the symbol representing the matching action in the action cube. That is, each cell in the 8x8x8 symbol cube contains a sequence of addresses in the action cube.

The action cube is divided into different types of function. At this point the need to give the language enough specificity to actually function requires that we dive in in some depth to the exact functions used. The address ranges in the Action Cube are as follows:

- 00-037: Actions on the functioning of Geometron itself, such as moving a cursor, deleting a symbol, or clearing a symbol. Taken together these types of action are called "root magic".
- 040-0176: ASCII. These numbers correspond to the printable characters standard on computers in the English speaking world. ASCII stands for "American Standard Code for Information Interchange" and is a universally recognized way to encode English characters on computers. The contents of these addresses are used to map key functions on a keyboard to anything in the Geometron Hypercube. For instance the address representing the letter lowercase 'a' is 0141, and in the default configuration that contains the address for "move forward by one unit", which is 0330. So when a user strikes the 'a' key, that adds the action "move forward one unit" to the sequence being edited. The symbols corresponding to these locations in the Action Cube are then symbols of the printable characters, which represent a font. That is, for example, the address in the Symbol Cube corresponding to the

lowercase letter 'a' is 01141. In the address 01141 in the Symbol cube we will find a sequence of actions describing how to draw a lowercase letter 'a'. This creates an immediate way to handle all human languages and keyboard mappings, as we can simply edit the contents of the Geometron Hypercube to both change key functions and change all the printable characters in a set of 95 from space bar to tilde.

- 0177: do nothing
- 0200-0277: Shapes. Each of these addresses contains a sequence of actions. That is, rather than computer code directly doing something, when one of these actions is triggered, it maps to a sequence of actions stored at that address. This can lead to infinite recursive loops, and it is useful to add functions that break infinite loops or avoid them. Formally, the sequences in this range can reference any address in the whole hypercube but by *convention* they are taken to generally be two dimensional constructions out of which symbols are constructed.

- 0300-0377: Symbol action geometry. This is the heart of what makes the whole system work. These are the actions which are used to create symbols in the various two dimensional computer formats: canvas, svg, png and base 64 encoded bitmap. In the implementation presented here each of these

addresses represents a function in JavaScript which can both edit a canvas element in HTML and edit a string which can be saved as an SVG file. This tablet will be documented in detail below.

- 0400-0477: Machine Actions. These can be used to control any machine, and generally consist of direct physical actions like "move robotic stage left one unit", or "turn on motor for one unit of time". In the implementation here they are either functions in Python which control the GPIO pins of a Raspberry Pi or are instructions to a GVM implemented in Arduino.

- 0500-0577: Shapes made up of machine actions. These are simply sequences of addresses anywhere in the Hypercube but by convention are all either machine actions in the 04xx range or other elements of this range itself.
- 600-0666: Shapes made up of 3d geometric actions. These are again just sequences of actions, by convention being in the range from 0700 to 0777 which are 3d constructions.
- 0700-0777: 3d geometric actions. These are used to edit 3d files or do 3d geometric actions. In the implementation presented here, what is edited are x3d files(formerly VRML) which are used for virtual reality and augmented reality, as well as constructions with the THREE.js library which can

export to .stl files for 3d printers.

As stated above, the heart of the system is the symbol constructions in the 03xx tablet. We now start with showing the whole tablet as follows:

These are broken up by category. The fourth row, the range from 0330 to 0337, are motions: move forward, back, left, and right, rotate left, rotate right, shrink and grow by the scale factor. The second row sets the scales: the factor by which a unit is grown or shrunk. By default this scale factor is two: grow actions double the unit, shrinks halve it. Other scales are 3, 5, the square root of two, the square root of three, and the Golden Ratio. Rotations to the left and right are by an amount set by the symmetries: fourfold symmetry is 90 degrees, five fold symmetry is 72 degrees, and six fold is 60 degrees.

These are all related! The diagonal of a square is the square root of two bigger than the side of the square, the diagonal of a hexagon used to make a six pointed star in it, is the square root of three bigger than each side of the hexagon. The diagonal of a pentagon which is used to make a five pointed star is the Golden Ratio bigger than the side of the pentagon. These relationships between simple symmetries and these ratios are fundamental to the structure of the Universe as we perceive it. Every culture in the world uses these fundamental symmetries for art and communication. By using these scales and movements we can move our virtual "cursor" to any di-

rection, with any angle, in any location at any scale. The third row sets styles. There are 8 styles, each of which has a fill color, line color and line width. By default these are black, thick black, then the rainbow colors in order: red, orange, yellow, green, blue, and purple. However, they can be set to any values. Final actions in relation to symmetries is halving angles, doubling them, trisecting angles and tripling angles. Between these and the angle 36 degrees it is possible to get any number of degrees down to the single degree.

With all this, we can proceed to the constructions. The most basic constructions are circles, dots, line segments, and arcs.

Also, bezier paths.

0365 word, vs. font with 01xxx, paths closed an open,

02xx: cursors, arrows, special scales, square,

products: laser cut shapes, icons, 3d assets for vr and ar, 3d print objects, clay fabrication with nail, generic 2.5 d printing, agricultural robots, electron beam lithography, quantum processor programming, specific fonts: laser cut, clay pixels

how robot code works with all this, examples

root magic: how to edit, how it works, very brief

hello geometron, very brief with link

how the system works with actual implementation, but very brief

examples: circuit diagrams, quantum gates

what this can do and why you should care These are broken up by category. The fourth row, the range from 0330 to 0337, are motions: move forward, back, left, and right, rotate left, rotate right, shrink and grow by the scale factor. The second row sets the scales: the factor by which a unit is grown or shrunk. By default this scale factor is two: grow actions double the unit, shrinks halve it. Other scales are 3, 5, the square root of two, the square root of three, and the Golden Ratio. Rotations to the left and right are by an amount set by the symmetries: fourfold symmetry is 90 degrees, five fold symmetry is 72 degrees, an

Chapter 9

2d Web Graphics

9.1 2d Web Symbols and Icons

- hello world vesica piscis
- symbols, how they work with hypercube,
- editing, keyboards, control panels, modes
- symmetries and scales, different methods of geometron(AG)
- cursor,movements, basic constructions(segment, circle, arc, dot)
- layers, colors, lines, style json
- bezier curves
- paths
- character stack
- fonts
- flags

- tracing symbols from images
- editing the hypercube and shape table, sharing them, import and export of hypercube, sharing of bytecode
- canvas,svg/png/base64 workflow, laser cut shapes production, practical graphics for manuscripts and web, iconsymbols, usage in jupyter notebooks, how the JSON embeds in the SVG, how the symbol feed works, how the setup of JSON works,
- control panels, softkey interfaces, writing geometron apps, how to replicate in other systems from scratch
- examples of using the GVM in JS, documentation of geometron.js, how to use

Chapter 10

Shapes and Fonts

10.1 shapes and fonts: examples

- editing shape stack, workflow, how to share, upload, download, send and store, same with fonts, connect to hypercube
- basic shapes built into 0200 thru 0217, how it's all connected to 01xxx
- pixel fonts
- laser cut fonts
- signal flag font
- general circuits
- quantum circuits
- graph theory, with digression into how to operate Maps with mathjax formatting for fully tex com-

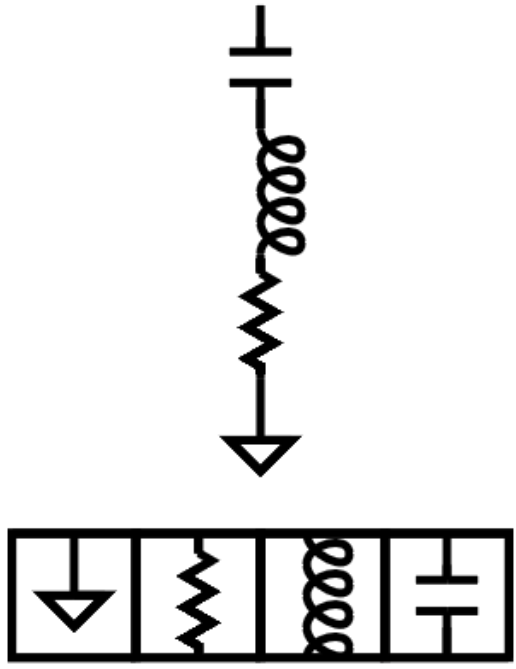

Figure 10.1: RLC circuit.

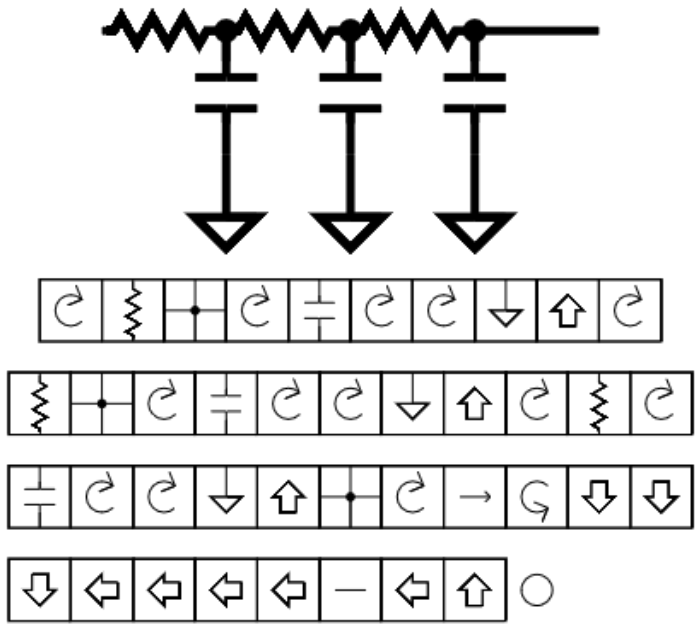

Figure 10.2: RC line circuit.

patible graph theory figure creation
- quantum logic gates
- classical logic gates
- standardized icon design for geometron system
- katakana
- hebrew
- laser cut shape set shape stack
- laser cut ruler
- laser cut protractor
- tree of life from western occult practice
- penrose tiles, fun with golden ratio, fivefold symmetry
- cross stitch design

Chapter 11

Machine Control

11.1 Machine Control

- introduction, the democratization of automation
- structure of hypercube, workflow, general principles
- trash robot printer
- wall robot on large building
- agricultural robot prototype/description
- dual winch robot
- electron beam lithography
- hacked 3d printer to make 2.5d printer

Chapter 12

Geometron in 3d and Beyond

12.1 Geometron in 3d and Beyond

- where it exists in hypercube, concepts of movement and construction, cursor
- file formats and software: THREEjs, .x3d, how they are used, 3d printing
- fonts: examples of pixel font of standard English letters and braille with hemispheres
- rotation angles of many part robotic arm tools
- quantum geometron: rotations in hilbert space, representation of hypercube in state of quantum pro-

cessor, direct mapping to protein folding without gates

- writing 3d geometron apps, how to use, how to expand and rewrite
- detailed documentation of the code

Chapter 13

Ontology

13.1 Ontology

1. the branch of metaphysics dealing with the nature of being.
2. a set of concepts and categories in a subject area or domain that shows their properties and the relations between them.

The purpose of our whole structure of knowledge is to create a civilization in which technology freely replicates. We will choose terminology and methodology entirely based on this criterion. The breaking down of things into sets composed of elements which are themselves things is based on this. We always choose that which maximizes the probability of replication and the

freeness of the thing being replicated. To this end, how do we define a "thing"? Topology of replication, meaning the connection in space and time between people, actions, places, materials, energy, information and other things which are required to replicate the thing. Set structure of replication, meaning the way we break the thing down into elements and those elements into sets with more elements to maximize the ability of the human mind to understand how to replicate the thing. And geometry, the specific geometric constructions that make up the physical replication of the thing. To create a Geometron Thing is to build whatever media we need to create and document the topology, set structure, and geometry required for replication.

We consider things in the most abstract sense. From things we create sets, which are also things. This section is a more formal mathematical treatment of the material in the "magic" chapter. It is more technical than that chapter, and does not reference magic, but does reference our specific implementation.

This is where the Theory of Self replicating sets is described. We point to the failures of the project of set theory in the 20th century, how it was a dead end, and how we can navigate out of the dead end by placing the mathematicians ourselves in the sets we describe. The whole failure of the old models of self replicating machines(perhaps this gets moved back to organic media chapter).

set notation, departure from ZF-C paradigm. New way of dealing with foundations of mathematics: the mathematician is part of the sets considered. And we continue this through the whole construction of math.

Foundational math in the paradigm of the 20th century was from ZF-C set theory to arthmetic, to algebra, to geometry, etc... but the whole edifice is based on sets which follow axioms, but those sets do not contain their makers. We create a foundation of mathematics in which the creators of the math are always in their own calculations, starting at the primitive level of what an "object" is and what a set of objects is. We consider not only ourselves to be elements of the sets in our universe, but every aspect of ourselves, our communities, our minds, and our ecosystems. For example, looping back to SRS, the desire to replicate a set is part of the set. A set might be

{ - powerpoint slide about self replicating sets - the desire to tell people about self replicating sets - the persuasiveness to induce others to desire to tell people about SRS - the means to replicate the powerpoint to the next user(e.g. posted on slideshare) }

From these sets we construct geometry which is used to make generalized symbols, which are used to make all the things in our technological complete set, which is again a part of our new approach to interacting with abstract sets.

Random notes:

unlike normal set theory, sets can be elements of each other(we call it “element”, not “subset”, to erase the distintion between set and some hypothetical non-set thing)

The structure of sets, the elements we choose to describe a set, are completely determined by what will be the most useful for replicating the set, for a human operator.

example Things:

The Terminal

The Geometron Terminal

The Pyramids

Audion

ArtBox

Trash Robot Icon Printer

Skeletron

laser cut shape set

laser cut ruler

custom laser cut shapes and stencils

13.2 On Self-Replicating Sets

2020

1. Computer Science and the Theory of Self-Replication

Throughout the history of modern computing machines, people have contemplated the idea self-replicating machines. At the dawn of the information age, John Von Neumann in particular devoted thought to the subject, creating a blueprint that people continue to use both for understanding hypothetical self replicating machines and for understanding the architecture of existing computing machines. At the same time, Alan Turing developed a similar toy model for how generalized computing machines work, which is taught in basic computer science classes to this day. We will not delve very deeply into these models, but will instead present a very crude sketch of them in order to discuss the assumptions made by computer scientists in the models they build to understand their world.

The Turing model of a computer consists of an infinite tape of 1's and 0's along with a machine to both read and change the state of the numbers in the tape. The string of numbers describes instructions for the machine, which follows those instructions by moving the tape back and forth and changing numbers from one state to an-

other. Turing was able to show that this toy model of an abstract computing machine could be proven mathematically to be equivalent to any other abstract toy model of any other kind of computer, including the complex machines built today(hence the continued use of this model in teaching and scholarship). This is considered to be one of the most important results in theoretical computer science.

Before discussing this model's limitations we must say a word about the nature of scientific models. When we investigate a thing using the scientific method we have in principle the entirety of science knowledge to call on, built up from a vast number of models in different fields and sub-fields. For example, if we are presented with a rock to analyze, a physicist might ignore everything but the crystal structure of some prominent material in the rock and bring the modern understanding of crystals to bear on it. The micro-biologist will only be interested in the aspects of the rock that interact with the organisms on the surface, while the ecologist will be interested in that but primarily how the rock regulates the flow of water through the ecosystem of which it is a part. As scientists we may agree that models of surface chemistry for microbes, models of how atoms arrange in crystals, and how water flows through rocky soil are all "good science", but in any given context the model we choose to focus on depends on that context.

It is our assertion that while the model of Turing and

his contemporaries is not wrong, that it is deeply misleading because in most cases it does not describe the most relevant aspects of the machines we call "computers". Computers do, of course, compute. That computation is described by the mathematics of computation. They also create heat, described by thermodynamics, and are we therefore to call them heaters? They keep time with extremely fast clocks, do we simply call them clocks? No. But what actually are they? What is the model for a modern computer which is most useful when trying to understand them? In this era, in the year 2020, the most useful model for a computer is the one that describes how they have totally changed all aspects of global society in a relatively short time. For this we must expand the models available, and in particular we must focus on a specific shortcoming not just of mid-20th century computer scientists, but of most scientists in the "modern" era, namely our refusal to put ourselves and the societies of which we are a part into the systems which we study. In some abstract sense, one can argue that we put ourselves into the models with the role of the observer in quantum mechanics for instance. But we do not put the role of something like university politics into the models, even though these forces clearly influence the science we use and hence the conclusions we draw. It is the assertion of this paper that this blindness has become so critical in the understanding of computers as to be wrong in a way that has real world consequences.

So what is the problem with a Turing machine? If we look at it naively as a physical thing, not as a mathematical toy, we see a number of things that are not realistic, such as the infinite tape and the lack of any meaningful human readable input or output. But these are typical of useful scientific models: while the tape is understood to never be really infinite, the results you can get from the machine with "such a large memory that it doesn't matter" and infinite mostly don't matter, so our toy model still works. But the critical flaw of the machine which gives us an incorrect understanding of how computers function in society is that it has no origin, no purpose, and no destiny. Who built this machine? Why? How long can it run before it breaks? What happens when it breaks? When it ceases to function, what replaces it and why?

We now live in a world where a large fraction of the computing machines that exist live on a trajectory from a mine to a landfill of less than 2 years. During this brief journey from mine to landfill, they are mostly used for communication, and much of that communication is marketing information the primary purpose of which is to lead to further consumption of similar machines. That is, *in their current state* the *primary* action of these machines is rapid replication.

This is the reason we must shift the *primary* scientific model of computing machines from the Turing model to a more biological understanding. If we seek to study a new

species of life that is taking over an ecosystem rapidly, we will always try to focus on the models that allow us to understand that phenomenon because it is what affects outcome. If a farmer asked us to evaluate a new crop blight and we came back with a deep study of how carbon chemistry works because all life contains carbon they would be very disappointed in the results even if they are technically correct. Likewise if we are to deal with the explosive changes to our physical world caused by computing machines we must focus on the means of replication. We will give an analysis of these means in the next section. However before doing that we must turn to the history of self-replication as an idea in mainstream computer science.

There are two main intellectual threads in this story: cellular automata and self-replicating robots. Interestingly, it is the former of these that actually have a vast experimental component and the latter which is entirely theoretical. Cellular automata are in some sense a generalization of the Turing model: they are sets of rules for multidimensional(usually 2 dimensional) grids of numbers, generally 1's and 0's, which follow some set of rules. These systems are simulated on real computers, and as time advances in a program we can see fascinating patterns of what appear to be naturally oscillating structures moving around in a visual display of dots on a two dimensional canvas. If the rules are created correctly, these structures can be made to replicate themselves. The lit-

erature on cellular automata is vast and complex and continues to be a very active field. Nonetheless, it suffers the same flaw as the Turing model: it exists in a vacuum, with an assumed infinite time, and no reason to exist(at least this reason is not part of the theoretical framework used to describe them), no origin and no ultimate destiny when it breaks. There is beautiful pure math to be found in these systems, but no illumination of how computers function as machines that copy themselves.

The second thread of self-replicating machines is the study of theoretical "robots that build robots". This has attracted some truly wild speculation. What is generally imagined is a totally automated system without human intervention in which a computer controls robots that mine minerals which are used to build both more computers and more robots. This is then imagined to be so self-contained that it can be used to expand out into the universe outside of Earth, eventually consuming all things into this vast, automated, technical ecosystem which does not need any living thing to grow. Technologists have imagined these systems, then promised that they can be a fantastical utopia of free things, but also warned that they can destroy the world by consuming everything in site. For decades, theorists have written very detailed descriptions of such systems, delving into metallurgy, synthetic chemistry and the like to try to prove that such a thing can be built. Most recently, the work of K. Eric Drexler and Ralph Merkle in the 1990s pointed to

a system like this built from precise positioning of atoms in matter–essentially treating physical matter as just another Turing machine. These theorists constructed very detailed imaginary worlds where atomically precise machines manipulate atoms to both compute and create, replicating themselves on a global scale. Perhaps their day will come at some future time and such machines will be built, but right now these models are of no help in understanding technology as we find it today. The rest of this paper is devoted to developing both a theory of self replication in modern technological society and in actually *using* this theory, just as the pioneers of modern computer science used Turing's model early on, to build new things based on the new model.

2. Self-Replication in Human society

First, a word on self-replication in biological systems that exist outside of human society. "Natural" biological organisms never replicate themselves in a vacuum. On Earth as we find it today, all living systems replicate as part of larger ecosystems, and the parameters of those ecosystems are *fundamental* to the overall replication. No animal can live long enough to reproduce without a constant flow of oxygen from plants needed for respiration. Conversely plants need the carbon dioxide we produce in order to live long enough to replicate. No one would dispute that a tree is a self-replicating thing,

and yet trees only replicate in collaboration with a large number of other organisms, generally other plants, fungi, animals, all working in concert to make the overall forest system replicate itself, of which the trees are only a part. What we find in spite of this, however, is that scientists outside of biology put much more restrictive rules on self-replication, saying a thing does not "really" replicate itself if it replicates as part of a larger system. Hence the flaw in computer models: if humans replicate machines, those machines are not called "self-replicating" because for the overly restrictive definition of the "self" of the machine they do not spontaneously replicate. But this type of isolated spontaneous replication does not exists in nature even for purely biological systems, so applying it to systems outside of biology will give results that are at odds with how the biological world works. Again, we must distinguish between models that are "right" and models that describe the primary characteristic of a system under study.

In the pre-industrial societies, *all* technology is self-replicating. Historically, people make technology using the materials found in their environment, generally from other organisms like trees(wood) and animals(bone) or found objects of which there is a plentiful supply. People then reproduce and teach the system of constructing such technology to the next generation, along with enough understanding of that technology that the young can in turn pass along the information when they age and are

passing it along to yet another generation. This type of self-replicating technological system can exist in stable dynamic equilibrium with existing ecosystems. Trees can grow, be converted to boats to hunt in, which lead to cooking technology to cook the animals killed in the hunt, and trees and game animals can then re-grow as future generations replicate their technology.

If we take this broader view of self-replication we don't even need to restrict ourselves to humans to see self-replicating technology. The beaver dam self-replicates quite easily and indeed before the rise of modern society one can imagine the dam itself as a self-replicating entity which uses the beaver as a vector, but which transforms the landscape vastly in excess of what one might imagine possible for a single small animal. To make sense of a landscape transformed by beavers it does not make sense to either study just beavers or just dams, we much consider the self-replicating set of dam-and-beaver as a single system. The same is true with human technology.

Moving into the very early reaches of our history as we learn it today based on written records, the next self-replicating systems are religions and empires. A religious text is perhaps one of the best prototypes for self-replicating technology which can shed light on the current state of affairs. Religious texts such as the Torah or the Koran describe both a world view which gives people a "why" to what they do which includes the replication of that text. They also include the description of

"how" to replicate the text, building up complex structures of education which teach the next generation of humans what they need to know to keep replicating the next down through the generations. The other main replicating structure is that of the military bureaucratic empire. An empire replicates by expanding to incorporate more and more people into the actions of further replication. This is generally done by force, which can keep growing by taking more land for more mining resources and also more people to continue to gain power to continue to expand, consuming other systems and turning them all into that one central imperial system.

The entirety of human written history can be looked at through the lens of these self-replicating systems, where the means of replication is the primary descriptor of the systems. The history of what used to be called "Christiandom" can be seen entirely through this light. The Torah was replicated by Jews for thousands of years, and was limited in its replication by Jews' only replicating it to other Jews, so the growth was limited by the biological reproduction of the people who did the replication. Then, when Christianity appeared, the same text was suddenly being replicated by the people of one of the vastest military empires every built, Rome. Ultimately this replication consumed Rome and became the Holy Roman Empire which among other things was a vast replication machine for the scripture. Then, due to technological advancements, it became possible to replicate that scripture

mechanically in bulk with the printing press, and we see another explosion of change in that world where the press and how it replicated religious scripture caused some very radical change. As Western capitalism developed, the King James version of the Bible, printed in bulk on mechanical presses defined the beliefs of the military empires that then went on to conquer the globe(singling out the British Empire, followed by the American as the most powerful of the lot). Nothing in our world today makes any sense without this story of evolving self-replication.

So now this brings us at last to the discussion at hand: self-replication in regards to modern computer technology. How do computers replicate? Just as an analysis of beaver dam replication requires understanding the trees from which sticks are harvested and the rivers which feed the beaver ponds, this analysis must include externalities that are ignored by theorists, such as investors and marketing. Modern computers exist as creations of a combination of mass market consumerism, venture capital investment, and government research and development mostly focused on the military. Every company that makes computer hardware and software today is the creation of a very specific process whereby an entrepreneur pitches a company to investors, who in turn pitch their fund to larger institutional funds like pensions. After they get funding, they grow using a very specific type of worker, the modern tech worker fully indoctrinated in a certain culture. That growth is made

possible by a system of mass media that transmits the information to consume the products to the masses outside of "tech". Those masses of people both put money into the products of this creation process and also put investment capital into the financial system that funds the venture capital that creates all this. Nominally all this is enabled by the "money" system which used to be based entirely on mining of minerals, but is now based on some complex system of faith more loosely based on mining. The computer systems which out-evolve their competitors are the ones that replicate the fastest. They are the ones that convince people to consume more and faster, and put more money and time into the system. The venture capitalist David Horowitz has explicitly said that in the future they are building everyone will either be forced to obey the media on these systems or will become one of the people building them. And indeed this is the logic of the self-replicating machine. People like David Horowitz have to exist in order for the machines to out-replicate other machines.

This picture presented here is of course a vast oversimplification and the product of a fairly brief and superficial analysis. It is not the purpose of this paper to create a full model of replication of modern "tech", but rather to convince the reader that *such a model is needed*, in the hopes that people will develop more accurate models that we can use to try to gain some control over this system and ultimately over our lives.

In summary, the simplest model for computers that I think we should consider now is not that of the Turing machine but of the advertising machine which exists for the sole purpose of convincing people to consume more advertising machines. This might take the form of presenting PowerPoint to investors, using computers to train the workforce to build the technology, or spreading an article in the tech press about some new technology, but in most cases it is just direct advertising to the consumer. But in all cases the primary characteristic which determines form is replication. This is why evolution of machines has favored more and more of the machine being screen, with the highest possible pixel density and color contrast, rather than maximal computation power. Pixels are what sell pixels.

We must also distinguish between viral replication and independent replication, although the line is blurry. Viral replication assumes a fixed system in which the information replicates. For instance, information can replicate itself within a commercial social media platform like Facebook or Twitter just as influenza can replicate in a host human, but this does not replicate the *system*. The means of replication of a system such as Facebook is in fact not replication of content, but the whole system including venture capital, technical labor, media to sell it, the legal framework to enforce the power of the company, etc. It is this full system replication that we are concerned with here, not the replication of information

within such systems, known colloquially as “memes”.

3. The *Potential* Power of the Open Web for Self-Replication

What is the Web? The Web is not the Internet. The Internet is a network that connects almost all computers in the world, both physically and with some software protocols. This network traces its origins to the network of military and academic(but military-funded) computers that emerged from ARPA back before the modern commercial Internet, going back to the end of the 1960s. The Internet can in principle be used to exchange any information and treats information in the same abstract sense as in the models of theoretical computer science discussed above.

The World Wide Web was initially the creation of one person: Tim Berners Lee. It was initially created as a directory for the large science institution Lee worked for(CERN). The Web works beautifully on the Internet and the Internet is what made it huge, but it is not the same thing. The Web is a system for encoding information for and by humans to communicate with other humans. It includes human readable code designed to create universal documents which link to each other and can contain images of all kinds and text in all languages, creating a sort of universal document in a universal lan-

guage in which all of humanity can communicate. While the modern Web is commercialized and increasingly not open to all users by default, this is a choice we have made that can be un-made. In principle any computer *can* be both a web server and a web browser. If we call the "open web" the collection of all web files which are openly viewable to anyone connected to the Network, the open web can in theory physically grow to include every computer in existence using the existing physical telecommunications network.

Let us now estimate the size of this potential Open Web network. We suppose that given the multiple billions of smart phones, laptops, servers in server farms, embedded systems, supercomputers, etc., that the total number of potential web servers is of order 100 per person. We then round human world population up to 10 billion, and estimate that there are 1 trillion total potential servers on the Open Web. Given that even a modest cell phone has a few gigabytes, but many servers and deep storage computers have terabytes, we can round up a little and say the average server can host 10 gigabytes of data. If a file like this one(this paper, the one you are reading rightnow) is 100 kilobytes to 1 megabyte, let's round to 1 meg and say there are 10,000 documents like this one(they could in theory all be math papers) for each server. So the total number of documents per person is 1,000,000. But we as a society *share* these documents, so in some sense what we all have is not 1 mil-

lion but 1 million times 10 billion or 10 quadrillion documents(10,000,000,000,000,000). The informational universe in which we construct this new mathematics consists of this network of 10 quadrillion linked documents.

This universe of information exists on web servers which can in general be made to run code that edits and replicates the documents. Thus *every* document in this universe of information can self-replicate and be edited in situ. If this is all on the Open Web with code that can be edited by anyone on the Web, all users can constantly edit all documents, so potentially we have 10 billion people all simultaneously editing 10 quadrillion files all of which are able to instantly self-replicate from any node on the Network to any other Node. This vast network effect can create power in the same what that billions of brain cells with massive interconnection, creating a document of greater power than any that has ever been possible before. The power of such an open system will be so vast that it will make no sense to have any private data. Without any property on the Open Web, things can replicate freely, and the increased value will be so great that it will consume private property online. This evolution will be physical as the value to the physical caretaker of a physical web server becomes greater to participate in the Open Web than to keep it in the commercial web. Note that if we try to simply write down the number of ways that these documents can point to each other to self-replicate, since each document can replicate from

any other document in the collection of documents(and any number can replicate from any one other document), the number of ways they can be structured is the number of documents to the power of itself. This is 10 to the 16 to the power of 10 to the 16. 10 to the power of a few hundred is already exceeding the number of estimated protons in the known universe. So one can make similar arguments about this system as people make in regards to quantum computation systems: we can even for a very small network build something that is totally impossible to simulate on a classical computer.

The power of a fully self-replicating and evolving Open Web on this scale is that documents can describe the replication of *physical* things, and the replication of the documents can include replication of the things. If things we use in our lives are replicated rather than purchased or mined, it changes the basic assumptions about what value is. Note that like "set", "thing" is used in a maximally general sense to include things like "a feeling of awe at the largeness of a tree" or "the tendency of cats with white fur to cause a change in the appearance of black clothing". The word "thing" is used here as a placeholder for *anything* which human language can be made to describe or point to.

In order to build these documents we must first define the idea of what exactly a self-replicating document is, and how it fits into more general concepts of self-replication. To that end we will take an excursion into

the math known as set theory, which is the next section of this paper.

4. Self Replicating Sets/Documents

Motivation and definitions

Set theory, is the mathematical study of sets. Sets are simply "collections of objects". The idea of a set as a collection of "objects" considers the idea of the "object" at a level of generality perhaps shocking to non-mathematicians. "Object" here can mean *anything*. Mathematicians generally mean by "any object" any object which a mathematician might talk about. However in principle it can be anything that anyone might talk about(as we seek to generalize these ideas beyond mathematics). For the purpose of this work we well define a generalized object to be anything which human language can possibly describe. Any word, symbol, or collection of words or symbols which point to something–that something is an "object". And a "set" is just a collection of such general objects.

The notion of a generalized object is familiar to modern computer programmers who use the idea of "object oriented programming" to create generalized objects which are used to build linguistic handles in human language on computer programs. Thus a modern programmer might define something abstract like "shopping-cart"

for an e-commerce website, and then that object will have properties like "list of objects" and "total price". We choose to take the path taken by foundational mathematics and have our basic concept from which all other concepts will be built be the collection of objects(which are themselves objects) be the fundamental idea.

In order to understand the motivation of this work it is necessary to trace very briefly the history of set theory. Through the end of the 19th and beginning of the 20th century there was a vast effort by some of the most brilliant mathematicians in the world to construct a universal mathematical theory base on the theory of sets and symbolic logic. Axioms were proposed, used to prove things, argued about, and re-written. The goal was to base *all of mathematics* on the axioms of set theory, and to go from there to a universal system of truth in which statements may all be proven to be true or false.

People like Bertrand Russel pointed out that such systems can create paradoxes that make it impossible to create a self-consistent system of logic/truth/math. This paradox can be summarized by considering the "list of lists that do not list themselves". The list defined here is a list of lists. Is this list on itself? If it is, it cannot be by the definition of itself. If it is not, it must be by the same reason. In spite of having publicly stated this paradox, Russel and his co-author Alfred North Whitehead wrote what is now considered a seminal work in mathematics *Principia Mathematica*(not to be confused with a book

by Isaac Newton of almost the same name), which attempted to create such a universal basis of mathematics. While the achievements of 20th century set theory, logic and analysis are fantastic and useful, they ultimately failed in their goals, and this was proven mathematically by Kurt Goedel in 1931.

In the post-Goedel world we should take for granted that no universal logical construction can be built which defines truth and falsehood without contradiction. Goedel's proof presented a fork in the road intellectually. We could have used this as the sign to go back through mathematics, accept contradiction as part of life, and build a math based on desired outcomes. In some sense this is what society did by mostly ignoring the work of most post-war mathematics(with some very narrow exceptions like number theory for cryptography). While professional mathematicians took the opposite fork, building increasingly complex systems based on each other, where a vast tower of ideas linked by formal logic built up from the axiomatic set theory of the early 1900s to create a bridge to nowhere. The sole purpose of most mathematical concepts and theory today are to advance the career of working mathematicians. We forget, both outside and inside mathematics, that people used to believe ideas in math actually *mattered*. We also forget that mathematics has for thousands of years been one of the most powerful tools the human mind has for understanding and interacting with our world, and indeed mathematicians have

traditionally played a central role in the largest power structures throughout history.

Having proved that a universal truth machine cannot exist, we may now abandon the project of early 20th century mathematicians such as Russel and Whitehead and proceed to reconstruct axioms of set theory based on a *desired outcome*. This system will not be judged on its ability to prove theorems, eliminate logical contradictions, or get tenure for math professors. It will be judged *only* on its ability to improve the human condition. It is time, finally, after almost a full century, to inherit the true legacy of Goedel.

Right now all of humanity is locked into one giant self-replicating set which has as elements all of industrial society. The purpose of this work is to create a set theory which enables people to construct sets which create the maximum amount of human freedom. To that end, we seek to make sets have elements that are defined as generally as possible and also which always have the *desires* of the creator of the set as an element. When we move forward replicating these sets in the new society we build, each act of replication involves also replicating this desire. We therefore only replicate that which transmits a desire that we consent to and agree with for some reason.

Let us make some statements here about the sets we want to define. We define self-replicating sets as sets which contain as elements the means to replicate themselves. We also state that since our goal is to create the

objects of our desire with our mathematics that whatever that desire or intent will always also be an element of the set. We maintain the tradition of both formal set theory and object notation on computer science and define sets in writing by listing elements separated by commas and contained in "curly braces" "{" and "}".

We also state that in general the sets we will construct will have a primary element, the replication of which is the purpose of the set. There might be many other elements and subsets which are needed for replication, but the *primary element* is defined as the element the replication of which represents the *primary intent of the creator of the set*. We thus make the human will, desire, or intent a fundamental element of our entire set theory. To distinguish our set theory from that of mathematics as it exists today we coin the term "set magic" to be the theory of sets which contain both the desires of the creator of the set and the means to replicate the entire set. This is loosely based off of the quasi-secular use of the word "magic" from both chaos magic and Thelema magick to indicate the attempt to impose the human will on the world we find around us.

Thus a way to express the most general possible self-replicating set from our newly defined set magic is:

```
set = {
    desire,
    object of desire,
```

```
    means to replicate this entire set
}
```

Note also that in order for the whole set to replicate, the desire of the creator must also replicate. This is what in our existing system is called "marketing" and "sales". Without first convincing another mind to share our desire for replication, it will not happen. The power of the open web is thus not just about replicating documents but replicating the desire to replicate documents–in modern parlance, just marketing. The commercial web has proven excellent at this, and the open web has the potential to vastly improve on that.

We further state from the outset that all self-replicating sets have externalities. These will be elements or subsets of elements which draw on the resources outside any given "closed" system in order to replicate. Thus rather than attempting to build a conceptually closed system and then finding that it is not closed as did earlier set theorists, we accept that we are building a less formal construction that will always have an externality and that we must describe what this is in order to properly define a set. The number of degrees of freedom of this externality is what limits the overall degrees of freedom of a system. For example, if an element of a set is "text reading system" that can be on any of many different technologies. Whereas if something has an externality "lithium ion polymer batteries", the entire system is re-

liant on that one technology and any threats to large scale extraction of lithium from the Earth are threats to the whole system. We thus seek to constantly struggle to improve on the externalities, with the ultimate goal for them to be in equilibrium with the living Earth.

A self-replicating document is an example of a self-replicating set(a "document" is just a collection of symbols, hence a set whose elements are symbols). This document is created as itself a self-replicating document according to the prototype we propose for the whole system. We now set forth to define the set which is this paper in theoretical terms, then to describe all the subsets which together make for a self-replicating set which can be evolved into other self-replicating sets. We now proceed to formally define the set which is this document.

This Set

The prototype self-replicating set we define in this paper is itself this paper, and is formally defined as follows:

```
On Self Replicating Sets[This Paper] = {
    The desire of the author to describe self-replicating
    A description of self-replicating sets,
    The means to replicate this set
}
```

The first of these will always be a part of the system of sets we are constructing here: desire. All sets are

defined with an element which maintains the desire of the author/creator/artist, and this is maintained as sets replicate to ensure that sets only replicate with the intent/consent of someone. Furthermore, we separate the thing being replicated from the means to replicate it. Elements are generally themselves sets which are broken down into more finely defined elements. This paper is part of the "description", but what formally is "this paper"? We seek to define it as a set, or a collection of elements contained in "description of self-replicating sets". This includes the following elements:

```
Description = {
    narrative structure,
    definitions,
    digital text document,
    pdf document
}
```

Now again we break off the replication methods from the thing being replicated. Replication is to happen on the Open Web. That is, it must have self-contained and self-replicating code that can copy itself from any web server to any other, and be edited after being copied, then copied again from the new instance so that the information is totally decentralized and evolves naturally as it's copied and edited. We also need this document to include instructions in human language(English in this

particular instance) on how to replicate the whole system, by either buying a domain and setting up paid web hosting or building a physically local web server to server the files. This document will contain that information. Furthermore, the replicator set must include the other media that are used to replicate the whole set, including content on commercial social media.

```
Replication = {
    code replication,
    server replication,
    pdf replication,
    in-person pitches and classes and discussions,
    media: email, post cards, posters, signs, commercial
}
```

Code and replication of code

The elements of the self-replicating code that can propagate this document across the Open web are as follows:

- replicator.php
- dna.txt
- filesaver.php
- fileloader.php
- `README.md`
- editor.php
- `index.html`

- `pageeditor.html`
- dnagenerator.php
- text2php.php

All of this code can be edited using the program `editor.php` which runs on any server that has php installed(most web servers). The file dna.txt represents this list of files, which replicator.php uses to fetch them and copy them to a new server(see below). README is the text of this document itself, and the name of that file is set by the standards used on Github so that by default any self-replicating document that's put up on Github has its content readable immediately. The format of the README file is by default Markdown. The save and load scripts are required to edit files on the server, and pageeditor is the page that uses these files to edit the main manuscript README.md. All php files are stored as .txt files so that they can be readable and easily accessed from the open web. The program text2php.php copies all the files in the php directory to the main web directory and changes the file extension from .txt to .php so that they can run. The file editor.php edits the copies in the /php directory, and then running text2php makes those programs executable.

Server replication

In order for replication to take place from server to server we need the ability to "colonize" new web servers with this code. This is done in any of several ways. Right now the main way is to buy a domain(usually about 10 dollars for the first year), pay for web hosting(5-20 dollars per month), then put the replicator program on the new server and run it. The second method used is to put a web server on a Raspberry Pi, a computer that can be bought for as little as 35 dollars and fit in a pocket which is excellent for serving web files over a local network. This allows for a grey area open web that is open to anyone on a local wifi network, and can see the rest of the Open Web but cannot be accessed by users outside that wifi network. In either case, the replication of the server consists of placing the file "replicator.php" in the main web directory of the new server, then pointing a web browser to [your new servers web address]/replicator.php. This will then cause the program to run, copying the rest of the system and linking to the main page which will display the newly replicated document.

The technical details of this process must be described briefly here in order for this document to truly self-replicate. We recommend buying a domain and getting shared hosting on dreamhost because they have proven to work with this code and are affordable and not a scam. One can also use any of several free web hosting options, includ-

ing 000webhost. In both cases you will find a file editor screen(this can be a little frustrating to find but always exists) which will allow you to create new files and edit them. Use this to create the file replicator.php and copy the code from here into it, save it and close it. On the Raspberry Pi, replication starts by making a new flash card with the operating system on it. One must then install the web server and php language using this set of instructions. After that one can move to the main web directory, copy all the files, change permissions, delete the existing page, and run the replicator:

```
cd /var/www/html
sudo rm index.html
sudo curl -o replicator.php https://raw.githubusercontent.com
php replicator.php
sudo chmod -R 0777 *
hostname -I
```

Once the whole thing has been copied, to have the *next* copy be a copy of this copy and not its predecessor, use the code editor to edit the file replicator.php so that it points to the global url for the dna on your new page, not the previous one. This is done manually for now. So if you do not do it, the next copy will be not of the new document but of its predecessor. Note also that once this system is installed anyone can run any code on your server, so no private or personal data of any kind

should ever share a server with this system. This system assumes that no private data exists unless it's on a physically isolated wifi network, and it must remain separate from the private Internet(especially anything with e-commerce, as stealing financial data would be trivial if that is ever done).

Another good practice as one works with files on the open web is that since we must assume all files might be deleted at any time, but we want the current copy to remain readable not just by us but by all users on the Network, we constantly back up text to free and open but non-editable paste sites like pastebin.com. To fork the whole code, one can edit on a live Open Web server, back up to a pastebin, and copy. But one can also create a github repository, copy the code locally to your hard drive, edit it on there, run dnagenerator.php to make a new dna file, then point your replicator to your github repository so that many copies can be made without the original being corrupted(using a hybrid between the password-protected space of Github and the Open Web which copies files from there). Note that while one can use any code editor for editing the local copy, we can keep a consistent system with the Open Web servers by running php -S localhost:8000 at the command line(I assume people who fork the code in this way know what this means) and connecting a browser to http://localhost:8000 to edit *in situ*.

Pdf document

As useful as the Open Web is, it is also useful to have documents in a traditional format which is compatible with physical paper printers to make copies we can carry outside of digital readers. To do this we have several options. We can print from the browser(which will look bad), we can convert to Microsoft Word which will corrupt the file and also look bad, or we can use the LaTeX system which will look great but take more work. For this initial instance we focus on the LaTeX version. As this document replicates and evolves hopefully more skilled users than the initial author will make smoother systems for conversion but right now a combination of the Haskell library "pandoc" and manual editing of the output file are the easiest way to convert from markdown to LaTeX. A document produced in this way is included in the replicator of this set.

```
pandoc -o paper.tex README.md
pdflatex paper.tex
```

5. Generalization and Social Implications

All ideas which we desire to propagate on the Open Web need all the typical means of use of media to try to convince others to replicate the document. In some cases we

seek to explain the whole thing in a tiny capsule of information, as with the "elevator pitch". In other cases we seek to show by example the power of these ideas. The media we expect will be used in the spread of this system include *all* media in the most general sense, including physical things like machines which carry various writing on them. Any physical thing can have a domain name on them which points to a document which describes how to replicate the physical thing. This extremely generalized definition of self-replicating document(as a type of self-replicating set) means any physical object can be thought of as a self-replicating document. Combined with the "Open Web" defined above, this can create an entire universe of useful things we can use to make up the fabric of our lives, building sets to live in which are independent of the existing industrial order.

Ultimately if we can build sets that we have the capability to evolve based on our desires, we can push that evolution toward what we call a "technological complete set". That is a set which describes a full self-replicating system that we can live in, which can exist in equilibrium with its environment just as pre-industrial societies did before the whole world was consumed by one very destructive set. In a complete set, the people who live in that set(we place ourselves conceptually into the set) have everything they need for a good life such as medicine, abundant food, clean water, the ability to live in a comfortable temperature etc. In addition, a set is

not complete if it is out of equilibrium: if a set requires constantly destroying things and not replacing them to exist it is not complete. As we look to the future this is possible in a way that is totally different from what was possible before the rise of industrial society. A future complete set based society has no reason to mine, since the quantity of material that has been extracted from the Earth and processed into very ordered structures is more than enough for a large human population to live on indefinitely.

This Technological Complete Set does not need to be designed and built by any one person or group. All that is needed to achieve such a set is to build sets which people have the capacity to evolve based on desire, and to impart into a group of people the desire to achieve this set(given the assumption that such a set is physically attainable). This document is meant to describe such a set, but also to serve as a seed which the author hopes will evolve in such a direction. By itself it is probably insufficient to build a large complex system, but it provides a prototype for a number of other self-replicating sets which we will construct and replicate over the Open Web. It is the nature of such sets that as they are created and released into the wild, they will all build on each other with network effects and that a small amount of exponential growth early on can create very large effects as the system evolves.

What is next in this program? The self-replicating

sets which are currently being created and released are largely about replicating symbols. Symbols and logos play a very powerful role in how our minds process the world around us. The ability to create a self-replicating symbol which has some intention imposed on it is one of the most powerful forces in our world today. This is the power corporations wield with their brands, logos, and marketing messages. By building systems for very rapidly creating symbols, giving them meaning, and replicating them, we empower the masses with this same power. The media for the symbols includes artistic tools for physical media creation(stationary, wall art, postcards, signs) and digital media creation(vector graphics of simple geometric logos). From this power, we hope to build a fire that consumes the media landscape and transforms the nature of human existence on this planet.

Chapter 14

Trash Robot

14.1 Trash Robot

What is Trash Robot?

Everything here refers back to Ontology. We build this thing, show how to replicate it, show how replication can benefit the replicator, which stimulates further replication. Build things and sell them. Build things and use them. Build things and share them for mutual aid and benefit.

Metabusiness. SRS. Thing. Organic Media. Geometron vehicle. Maker swarm. Methodology. Trash Magic(self replicating media from trash, seed of full complete set).

The Open Brand

rainbow and googly eyes. Soft black textiles. Felt. Geometric constructions from Geometron. Use of geometry in cardboard fabrication, HDPE sheets. Modularity. Things carried in cloth bags. Blocky geometric font. duct tape and cardboard and sticks. Things built from trash. Images of the things: box, flag, shirt, pants, bags with robots. The fashion brand.

The ArtBox

how to build. How to use. The tape snake. the Trash Tie.

Laser Cut Acrylic

Shape set. Rulers. Protractors. Penrose Tiles. Custom prints. Spray stencils.

skeletron

poles, geometry, tetrahedron, octahedron, icosahedron, tripods, flag poles, S Hooks, photos of constructions

textiles

the font. flags. Bags. Clothes. Methodology. Fashion business on the street. all the layouts of the designs.

Waving the flag with the pole. Power of the flag to direct traffic to pages in the Network over the cardboard sign, legitimacy via the open brand.

The icon token printer robot

Build the brain.

Build the controller.

Build the mechanicals.

Workflow: image feeds, align, trace, share, print, bake, stamp, replicate, paint and sand, build into sets, share and sell, make pendants, stitch into clothing and accessories, make jewelry. Make more robots. Donate, share, and sell robots.

Some notes on the pi version, how this can be a pi driven robot.

Arduino Generic Shield

This is a stub. It expands into many technologies but we document just the board and most basic of codes. Future technologies will reference this.

```
Trash Robot = {
    ArtBox,
    Trash Tie,
    Tape Snake,
    Token Printer,
```

```
    Terminal,
    Brand,
    Textile,
    Shop,
    skeletron,
    constructions
}

constructions = {
    duct tape,
    cardboard,
    trash ties,
    HDPE sheets
}

shop = {
    ArtBox purse,
    Trash Robot branded clothes,
    laser cut acrylic,
    token printer kits,
    tokens,
    pendants,
    printed bottle caps,
    terminal install
}

laser cut acrylic = {
    golden triangles,
```

```
    penrose tiles,
    full set,
    ruler,
    protractor,
    custom shape,
    spray stencils
}

printer = {
    brain,
    controller,
    mechanicals,
    workflow
}

    printer workflow = {
        build, share, sell, use printers, following instructi
        use Geometron server to follow the rest of this workf
        image feeds,
        aligner,
        trace,
        share feed with other users, save, copy, paste, share
        load code into Arduino, print in clay tablet, bake it
        use print to create stamp, sell or give away or use,
        use stamp to create both coin-like tokens and pendant
    }
```

Chapter 15

Full Stack Geometron

15.1 Full Stack Geometron

- end goals
- hybrid fabrication technology
- clockless operation, hardware GVM
- image stack, hardware map processing
- roctal, storage hardware, scaling, read/write/operate
- large projections in Skeletron booths, Geometron station, fully immersive VR/AR at 2 meter scale