Artist Thread In Focus

terra0

Carnegie Museum of Art

Blockchain

Introduction

Throughout their work, terra0 experiments with the use of blockchain—a type of digital technology in which information is stored in individual segments, called "blocks," and linked together, forming "chains." Blockchain is unlike other forms of digital information storage in that it does not require a central database for storage. Instead, copies of each blockchain are stored on separate computers, called nodes, which are linked together in what's called a peer-to-peer network. All the computers in this network have equal access to the data, and share responsibility for maintaining it. This makes blockchain both safer and—because it belongs to *many*, rather than one—more democratic than other forms of data storage. This section invites you to engage with the concept of blockchain in further depth.

> "Don't get me wrong: these are all test cases, and this is all an experiment. And of course our approach is not to find the solution—this shouldn't sound like a tech solutionist thing—but to use this technology to propose a different view and then see what others take from that." —Paul Kolling, terra0

Terms

Bitcoin A digital currency—or form of money—otherwise known as cryptocurrency, which can be bought and traded online. Bitcoin uses blockchain technology to make every monetary transaction transparent, traceable, and accessible to all.

Blockchain A type of digital technology in which information is stored publicly in segments called blocks. These are linked together to form blockchain. Each blockchain is stored across multiple computers, called nodes, that together form what's called a peer-to-peer network. No single computer or person has control over the stored information. Instead, access and control are equally distributed across the network. Usually, blockchain is used to record financial transactions—that is, the exchange of money—but it can also be used to record everything from the weather to healthcare information.

Cryptocurrency A digital currency—or form of money—in which transactions are made via blockchain. Bitcoin is an example of cryptocurrency.

Decentralized Autonomous Organization (DAO) An organization controlled by the organization's members instead of a central leader. DAOs are run using blockchain technology.

Environmental Impact Blockchain is stored across millions of computers, resulting in extreme energy use. For example, as of July 2022, Ethereum, the second-largest blockchain network, was estimated to use 62.77 terawatt-hours of electricity per year—comparable to the power consumption of Switzerland. The average Ethereum transaction required 163 kilowatt-hours of electricity, which is the same amount of power that an average US household consumes in 5.51 days. Though companies are working to reduce the impact of blockchain on the environment, for now it remains a major obstacle.

Ethereum Network The name for the blockchain network used by terra0.

Hash A special code given to each block in a blockchain.

Mediator Someone who operates between parties. For example, if two people are negotiating a contract, the mediator works between them to make sure the process runs smoothly. In this case, the mediator would likely be paid for their labor.

Nodes Another word for the servers where blockchain is stored. Nodes ensure everyone interacting with the blockchain has the same data.

Terms

Non-Fungible Token (NFT) A unit of data stored on the blockchain, which can be sold and traded online. NFTs can be linked to digital or physical items such as art or music, and used as stamps of authenticity, increasing the value of a given piece of art or music.

Peer-to-Peer Network A group of computers that are linked together with equal permission and responsibility for maintaining data. In blockchain, each block of data needs to be independently verified by peer-to-peer computer networks before they can be added to the chain.

Smart Contract A computer program that can automatically carry out, control, or document the terms of a contract or agreement, without the need for a human mediator, and therefore with less risk of human error or tampering.

Timestamp A stamp given to each block in a blockchain that records when the block was created or edited.

Connect

- Blockchain stores information in multiple places, instead of one centralized location. What might be some pros and cons of this way of organizing?
- Blockchain is designed to function without need for human mediators. What might be some pros and cons of not using human mediators?
- Blockchain operates by consensus—that is, every computer in a blockchain must approve edits to individual blocks. Have you ever had to reach a "consensus" within a group? How did that experience make you feel?

Paper Blockchain

In groups of four or more, create "blockchains" on paper, with handmade stamps.

Goals for this Create

- Deepen understanding of blockchain by creating a paper version
- Practice drawing skills
- Practice working in a group and building group consensus

Materials

Pens, scratch paper (for initial sketches), 8.5 in. x 11 in. paper (for final product), foam core or cardboard cut into roughly 2 in. x 2 in. squares (enough for one square per person), liquid glue (Elmer's or hot glue), glue sticks, inkpads.

Create

Part 1
Working individually, each person should do the following:

1 **On scratch paper, sketch ideas for a stamp design.**
- You might draw anything from a series of dots, to a single shape, to the first initial of your name, to something recognizable like an eye or a tree. Remember, your stamp will be roughly 2 x 2, so don't draw anything too elaborate.
- Decide on a final design.

2 **Make a stamp.**
- On a 2 x 2 piece of cardboard or foam core, draw your design using liquid glue, like hot glue or Elmer's.
- Wait for the glue to dry. You now have a stamp!

3 **Prepare your paper.**
- Take a piece of 8.5 x 11 paper.
- Fold it in half lengthwise.
- Cut it in half along the fold.
- You should now have two pieces of 4.25 x 11 paper.
- Selecting one piece, fold it in half widthwise (to make it 4.25 x 5.5), and then again (to make it 4.25 x 2.75).
- Unfold it. You should now have a 4.25 x 11 piece of paper divided into four sections by folds.

4 **This paper will eventually serve as your "blockchain."** The individual sections will serve as blocks!
- Soon you will divide into groups. The number of blocks (or sections) on each person's piece of paper should match (or be slightly greater than) the number of people per group. For example, if there are four people in a group, each person should have a piece of paper with four sections.
- If the groups are larger than four people, and you need more blocks, follow step 3b again. Then:
- Attach your second piece of paper to the first.
- Fully overlap the bottom square of one piece with the top square of another.

- Glue those pieces together with a glue stick.
- You should now have a very long piece of paper divided into seven sections.
- Repeat this process as needed until every individual in the group has a long piece of paper with the same number of sections as people in the group. (If there are one or two extra sections, that's ok, but there shouldn't be fewer sections than people in the group.)

Part 2
Create groups of four or more people. These groups will serve as DAOs, and use blockchain to keep track of important information—in this case, a series of stamped designs. Each group should do the following:

1 **Form a circle.**

2 **Every person in the circle should have a single, long piece of paper and their own, unique stamp (as created above).** Remember, think of the individual sections of paper as "blocks," and each long piece of paper as a "chain." The stamps will serve as information stored on the blockchain!

3 **Take turns stamping the paper blockchains.**
- Choose someone to go first. Because DAOs are decentralized—that is, no single person is in charge—consider choosing the first person by drawing names from a hat or using another democratic selection process.
- This person, Person 1, should place their stamp in ink, and stamp the *top* square of each "chain" in the circle. If more ink is needed, add more ink, but don't change ink color! There should only be one color per stamp.
- Choose a second person. This person, Person 2, should place their stamp in ink (either the same color as Person 1, or a different color; it doesn't matter) and stamp the second square of each "blockchain" in the circle.
- Repeat this process until everyone has stamped their design on each paper "blockchain," Person 3 stamping block 3, Person 4 stamping block 4, and so on.

4 **Everyone should now have their own copy of the same blockchain!** That is, everyone's piece of paper should have the same stamped designs, in the same order, running vertically from top to bottom of the paper.

5 **Optional** Blockchain is a decentralized technology. In order to edit any single block in the chain, the majority of users need to vote on and approve the edit. Experiment with editing or changing the blockchain.
- For example, maybe Person 2 wants to change the color of their stamped design. Person 2 can propose the change to the group.
- If more than half of the group agrees to the change, Person

2 can re-stamp the second block on *every* chain with a new color (either by overlapping the new color onto the original color, or stamping elsewhere within the same block).
- If the majority of the group does not agree to the change, the change can't happen.
- See how many changes you can make or prevent by voting in this way!

6   **Reflect** How might this activity relate to actual, digital blockchain?
- In a blockchain, important pieces of information are linked together, and every chain is stored in multiple places. This makes the information safer. In this activity, the information is represented by the unique, stamped designs.
- Imagine what would happen if someone—for example, Person 4—had accidently forgotten to stamp their design onto someone's piece of paper—for example, Person 1's, and someone else needed to find the original, or "correct," order of stamped designs. In this case, there'd still be a record of the "correct" order, because everyone else in the group would have a copy it.
- Compare this to what might have happened if there were only one single piece of paper. If one of the stamped designs—or, one "block"—were erased or tampered with, there'd be no way of finding out what the original or correct order of designs was.
- In actual blockchain, the information on each block would be transformed into a secret code, called a hash. Each block would also have its own unique timestamp, marking when a particular block was created. All of this would provide an extra level of security.
- Actual blockchain can contain all kinds of information, including financial records, health statistics, or sports scores. What other information could you imagine storing on blockchain?

Autonomy

Introduction

Across multiple projects, terra0 explores the concept of autonomy (that is, the right to govern oneself) as it relates to nature. This section probes further into what autonomy means, who or what has a right to experience autonomy, and how autonomy relates to nature, corporations, the law, and human lives.

"If a tree is economically responsible for itself, can it likewise protect itself from changing environmental regulation and the sway of business interests?"—terra0

Terms

14th Amendment An amendment to the US Constitution passed in 1868, which granted citizenship to all persons born or naturalized in the United States—including former enslaved people—and guaranteed all citizens "equal protection of the laws." It is one of three amendments passed during the Reconstruction era to abolish slavery and establish civil and legal rights for Black Americans.

Autonomy The state of being free to self-govern and make choices, including moral choices.

Corporation An organization—usually a group of people or a company—that acts as a single entity, and is considered a "person" under the law.

Economy The wealth and resources of a country or region, especially in terms of their production and consumption, and how this wealth is managed.

Interdependence A state of being reliant on others.

Legal Person Any person, or entity that can do the things a human person is usually able to do in law, including enter into contracts, own property, and so on.

Property Something owned or possessed, including real estate.

Self-governance Similar to autonomy, the state of having control over oneself or one's affairs.

Social Welfare Systems that provide healthcare, housing, and other programs that support the wellbeing of the community.

Tax Status Status that determines how much a person owes the government in taxes.

Connect

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terra0, *A tree; a corporation; a person. (DAO #01, Black gum tree, Pittsburgh PA)*, 2022, black gum tree, certificates of care, 501(c)4, smart contract, dimensions variable, courtesy of the artists and Carnegie Museum of Art; photo: Tom Little

The photo above shows a tree planted by terra0 as part of the 58th Carnegie International. The tree grows on land donated by the Community College of Allegheny County, in Pittsburgh's North Side neighborhood. While Carnegie Museum of Art is responsible for caring for the tree, the tree is registered under 501(c)4 social welfare status—a special status for non-profits devoted to social care, under which they do not have to pay taxes—and will eventually own itself. The tree's tax status is controlled by blockchain technology, a type of digital technology in which information is stored across multiple platforms, and no single entity owns or controls the information. In the case of the tree, this means its tax status is safe from human error or economic influences.

Connect

- Reflect on the artwork and information at left. How is the terra0 tree similar to or different from other trees?
- terra0 considers this tree a sculpture. In what ways might this tree be a sculpture? In what ways might it be considered art?
- Why might terra0 have titled this artwork *a tree; a corporation; a person*?
- What might trees, corporations, and people have in common? How might they differ from one another?
- In your opinion, what should be the rights of people? Of nature? Of corporations? Could these things exist without the law?
- In the US, corporations are often considered legal persons, in a reinterpretation of the 14th Amendment. The amendment was passed in 1866, after the Civil War, to protect the rights of freed enslaved people, and guarantees every "person" the "equal protection of the laws." In 1881, in order to evade paying a special tax on railroad property, financier Leland Stanford—owner of the Southern Pacific Railroad—argued that the railroad, too, should be considered a person. Ever since, corporations have been arguing for—and winning—status as legal persons. This happened notably in the 2010 Supreme Court case Citizens United vs. Federal Election, which granted corporations the right to finance political campaigns. In your opinion, should corporations be considered legal persons? Why or why not?
- In your opinion should trees be considered legal persons? Why or why not?
- What might be the relationship between legal personhood and the economy? Between legal personhood and autonomy (that is, the right to self-govern or make free choices)? Between legal personhood and property?

Journal of Autonomy

Create a journal of autonomy as you experience its presence or absence on a regular basis.

Goals for this Create

- Think about autonomy in relation to your own lived experience
- Explore systems of power you may be a part of
- Practice introspection
- Practice keeping a daily or weekly journal

Materials

Blank notebook and writing implement, or a word processor on a computer.

Connect

- What do you think of when you hear the term "autonomy"?
- What factors might contribute to a person's autonomy?
- What factors might take away from a person's autonomy?
- In what circumstances do you feel more autonomous?
- In what circumstances do you feel less autonomous?
- Are any of us fully autonomous? Why or why not?
- What is the relationship between autonomy and interdependence, or community?
- Is everyone equally autonomous? Why or why not?
- Can you think of situations in which letting go of your own autonomy might be rewarding? Can you think of situations in which it might be harmful?
- What is the relationship between autonomy and choice? Freedom? Authority? Justice? Politics? The environment? Race or gender? Mental or physical wellbeing?
- What is the relationship between autonomy and the law or human rights?
- What political or social systems might support or protect autonomy? What systems might undermine autonomy?

Create

1 **In your "autonomy journal," begin by describing what autonomy means to you.** What might being fully independent look like, sound like, feel like?

2 **In a separate entry, create two columns, one for "wants" and one for "needs."**
- List words in each column that fall under these categories. For example, "wants" might include: "new shoes" or "a high school diploma." "Needs" might include: "water" or "community."
- **Reflect** In what ways are these wants met, or not? In what ways are these needs met, or not? Does having these wants and needs met, or not, affect your sense of autonomy?

3 **During a set period of time (for example a week, several weeks, or a month), keep track of ways you experience or express autonomy, and ways your autonomy might be undermined or threatened.**

- For example, on one day, you might write: "Today I expressed autonomy by choosing what I wanted to wear to school." And, "Today my sense of autonomy was undermined when I had to go to school (or work) instead of hanging out with my friends."
- Note what these experiences look like, sound like, and, most importantly, feel like. For example, choosing what you wear might make you feel happy, excited, or empowered. Going to work might make you feel annoyed or resentful, because you wanted to spend that time doing something else.
- Feel free to add colors or sounds to your descriptions. You might associate gray with going to work, for example, or vibrant music with choosing what you wear.
- Delve deeper into these moments, and reflect further. Try to suspend judgement and notice as much as you can. Are there ways the line between autonomy and the absence of autonomy is blurred? For example:
- When you choose what you want to wear to school, what factors might influence your choice? Are you wearing something popular or something that the fashion industry "wants" you to wear? Are you wearing something because it strikes you as different from what others are wearing and you want to stand out? Are you wearing something because it's what was available or affordable?
- In spending the day at work or school is there any value in it for you? Why or why not? Is there a difference between working for someone or something you care about and someone or something you don't?
- Do these reflections change anything about how you view autonomy? If so, how?

4 **After the period of journaling ends, look back on your journal and reflect again.**
- Has your sense of autonomy shifted. If so, how?
- In what ways can you continue to express autonomy in your life?
- In what ways can you nurture and respect the autonomy of others in your life?
- How might your own autonomy intersect with and relate to that of others?

Natural Resources

Introduction

terra0 is the name of a group of developers, artists, and researchers. It is also the name of a theoretical (that is, it exists as a concept but not yet in actuality) forest, in a project that the group created. This theoretical forest governs itself via blockchain technology (a special kind of data storage, explored further in the Blockchain section). It also controls its own natural resources supply, choosing when or how to issue logging licenses. In this model, rather than a passive resource, the forest becomes an active agent and participant in capitalism, exerting control the way that humans or corporations might. This section invites you to explore natural resources in your own environment, and to reflect on nature as more than something to be used or consumed.

"Those whom my ancestors called relatives were renamed *natural resources.*"
—Robin Wall Kimmerer, mother, scientist, professor, and enrolled member of the Citizen Potawatomi Nation

Terms

Agency The capacity, condition, or state of acting or of exerting power.

Anthropocene The current geological age, beginning with the Industrial Revolution, in which humans have left a lasting and irreversible impact on the environment.

Blockchain A shared, digital database where data is stored in digital blocks and can't be easily edited or tampered with.

Capitalism An economic and political system in which a country's trade and industry are controlled by private owners for profit.

Commodity A raw material that can be bought or sold.

Exchange-Value The value of an object in relation to other objects, or what it might be worth in trade or currency. For example, the exchange value of a bottle of water might be $2. Usually, the rarer the object, the higher its exchange-value.

Fracking Short for hydraulic fracturing, a drilling technology used for extracting oil, natural gas, geothermal energy, or water from deep underground. Fracking can cause health problems, impair landscapes, and threaten wildlife.

Industrial Revolution A period from 1760 to about 1850 in Great Britain, the United States, and Europe that marked a shift from a hand-craft and agrarian (or farming) economy to one dominated by machines and large-scale manufacturing.

Logging The activity of cutting trees and preparing timber. Pennsylvania lost a large percentage of its forest to the logging industry in the 19th and 20th centuries.

Natural Resources Resources drawn from nature, including plants, water, soil, minerals, and animals.

Property Something owned or possessed, including tracts of land.

Raw Materials The basic material from which a product is made. Often, raw materials are the same as natural resources, or natural resources in slightly modified form. Examples of raw materials include wood and leather.

Use-Value The value of something according to how it directly meets physical, emotional, or material needs. For example, a bottle of water might have use-value for humans in that it quenches thirst.

Connect

- Thinking about the terra0 project described above, what do you think about when you hear the term "forest"? Feel free to list objects, feelings, or other associations, for example "shelter," "scary," "peaceful," or "fairy tales."
- Use-value is the value of something according to how it directly meets physical, emotional, or material needs. In what ways might a forest have use-value?
- Exchange-value is the value of an object in relation to other objects, or what it might be worth in trade or currency. In what ways might a forest have "exchange-value"?
- What do you think of when you hear the term "nature"?
- What do you think of when you hear the term "natural resources"?
- Typically, in capitalist production, "natural resources" (in terra0's case, the forest) are treated as raw materials, without any agency—that is, control or free will—of their own. Why might the collective terra0 have wanted to give the forest agency?
- terra0 is about granting a forest agency under capitalism. In your opinion, do trees need capitalism? Do trees need humans?
- What are some examples of natural resources?
- What might be the relationship between "natural resources" and "nature"?
- What might be the relationship between natural resources and the economy? Value? Property? Politics? Power?
- Who controls natural resources?
- Who benefits from the extraction (or removal) of natural resources?
- What are some natural resources that fuel the economy in your region? (For example, in Pittsburgh you might say steel, which is made of iron and carbon.)
- Are natural resources unlimited? Why or why not?
- n what circumstances might you feel close to or in touch with nature? In what circumstances might you feel separate from it?

Resources Rewilding: A Map

Create a map, using images and words, of your built environment in relation to natural resources. See how far back to the "source" of your built environment you can go!

Goals for this Create

- Explore how natural resources are all around us, and reflect on the ways we interact with them everyday
- Research what the objects in your daily environment are made of

Materials

Paper or posterboard, drawing supplies including pens, pencils, or colored pencils.
Optional Images printed from the internet, scissors, glue.

Terms

Rewilding The process of letting nature take care of itself, including regrowing or repairing itself.

Create

1 **Look around your classroom, your bedroom, or another room where you spend a lot of time and make a list of at least five objects that you see.** For example: a chair, a lightbulb, a picture frame, a cell phone, a shirt.

2 **Next to each object, list the natural resources that you think were used to create it.**
- Start simply, and feel free to guess. For example, a wooden chair might have been made with trees, and, if it contains metal parts such as nails, minerals.
- Do some research. Can you get more specific? For example, you might search what a cell phone is made of and find: copper, tullerium, lithium. Then, you might research even further, finding out what copper is and what it looks like in "raw" form.
- What other resources might have been used to create the object? Water? Energy from the sun? Write those down.

3 **If you can, find out where the object was made and write that down.**
- What country was it made in?
- Was it made in a factory, or by hand?

4 **Then, think about how the object arrived to you and what other natural resources may have been used along the way.** If the object came by ship, for example, it might have required fossil fuels. You can get even more specific by researching what fossil fuels are made of. Write down what you find.

5 **What can you discover about the people involved in creating this object?** Think about who was involved in creating this object. Think about everyone from factory workers who made the parts, to workers involved in shipping the object.

6 **On a blank piece of paper or posterboard, depict the objects you have chosen.**
- You might draw the objects, or cut and paste photos you have downloaded or taken yourself.
- You might depict the whole "room" you are focusing on, and the objects within it, or you might depict just the objects themselves.
- Make sure there is enough space around each object to add words and further images.

7 **Represent the natural resources in words, images, or both. Draw lines stemming out from each object to the natural resources the object is made of.** For example, an image of a chair might be linked to the words "trees" and "minerals," with an image representing each.
- Be as specific as possible. If you know the chair is made of "oak," for example, find or draw a picture of an oak tree.

8 **Do this until you have "mapped" each object you chose!**

9 **Optional** Create a new map or image of the room that includes ONLY the natural resources. For example, a classroom might be comprised of trees in place of desks, sand and limestone (for glass) in place of windows, etc.

10 **Optional** Do this activity as a group, or whole class, assigning a different object to each person. Create a resource map together.

11 **Reflect** How might learning more about what the objects in your environment are made of affect how you view those objects? How might it influence your understanding of the built environment in general?

Blockchain

Autonomy

Natural Resources