



Souls

The community-run cryptoart protocol powering a new kind of art

NBC Core Team

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Abstract. Souls is an open-source project and cryptoart protocol that portrays the future of Bitcoin as vastly more helpful than just a currency. The Souls protocol is a system of interconnected living artworks, trustlessly choreographed by unstoppable smart contracts, financially managed by a collector-run DAO, and powered by a native cryptocurrency. Unlike any artworks before it, Souls artworks are soulbound and therefore non-transferable. You cannot buy and sell a Soul. Also, unlike any artworks before it, Souls artworks are living organisms—they leave their collectors and join the Souls orphanage if their collectors stop taking care of them. The only way to collect a Soul is to adopt an abandoned one from the Souls orphanage. Visually, on the micro level, each Soul is a dynamic artwork that personalizes itself based on the collector's belief in the future of Bitcoin over time. And on the macro level, all Souls artworks collectively embody our behaviors in crypto, such as Fear (FUD), Greed (FOMO), and Belief (HODL)—creating a collective performance art experience.

1. Beyond art?



Souls is an experimental attempt to push the boundaries of cryptoart beyond individual artworks. While projects such as Fidenza, Autoglyphs, and Squiggles have attempted to create individual artworks with code, Souls attempts to create a cryptoart protocol.

Souls protocol is a system of interconnected living artworks. The artworks interact with each other via a set of unstoppable smart contracts. Decision-making on how the protocol operates is done by a collector-run DAO. And a native cryptocurrency, GM, powers the protocol.

You might be thinking: aren't current generative art collections already cryptoart protocols? Not quite. Artworks in the same collection are generated by the same algorithm with different seeds. Still, they don't interact with each other. Once generated, each of them is an independent piece of art.

A protocol isn't just a collection of things—it's much more than the sum of its parts. Your body is a protocol with elements such as the brain, heart, arms, and legs. A sports team is a protocol with elements such as players, coach, field, and ball. Our society is a protocol. So is a city, a factory, a company and a school.

The Souls protocol consists of three things: elements, interconnection and purpose.

Elements

Here are the key elements of the Souls protocol:

- **The Souls Artworks:** 1,247 generative artworks
- **The Souls Lifecycle:** a smart contract that coordinates interactions among Souls
- **The Souls Orphanage:** a smart contract that manages the adoption process
- **The Souls DAO:** a smart contract that governs the treasury and the protocol
- **The Souls Interface:** a website that lets collectors easily interact with the protocol
- **The GM Token:** the native cryptocurrency of the Souls protocol

Interconnections

Here are the key interconnections of the Souls protocol:

- A collector adopts a Soul
- A Soul leaves a collector who abandons it to join the Soul Orphanage
- Souls collectively perform the artworks
- Collectors *collectively* make decisions via a DAO

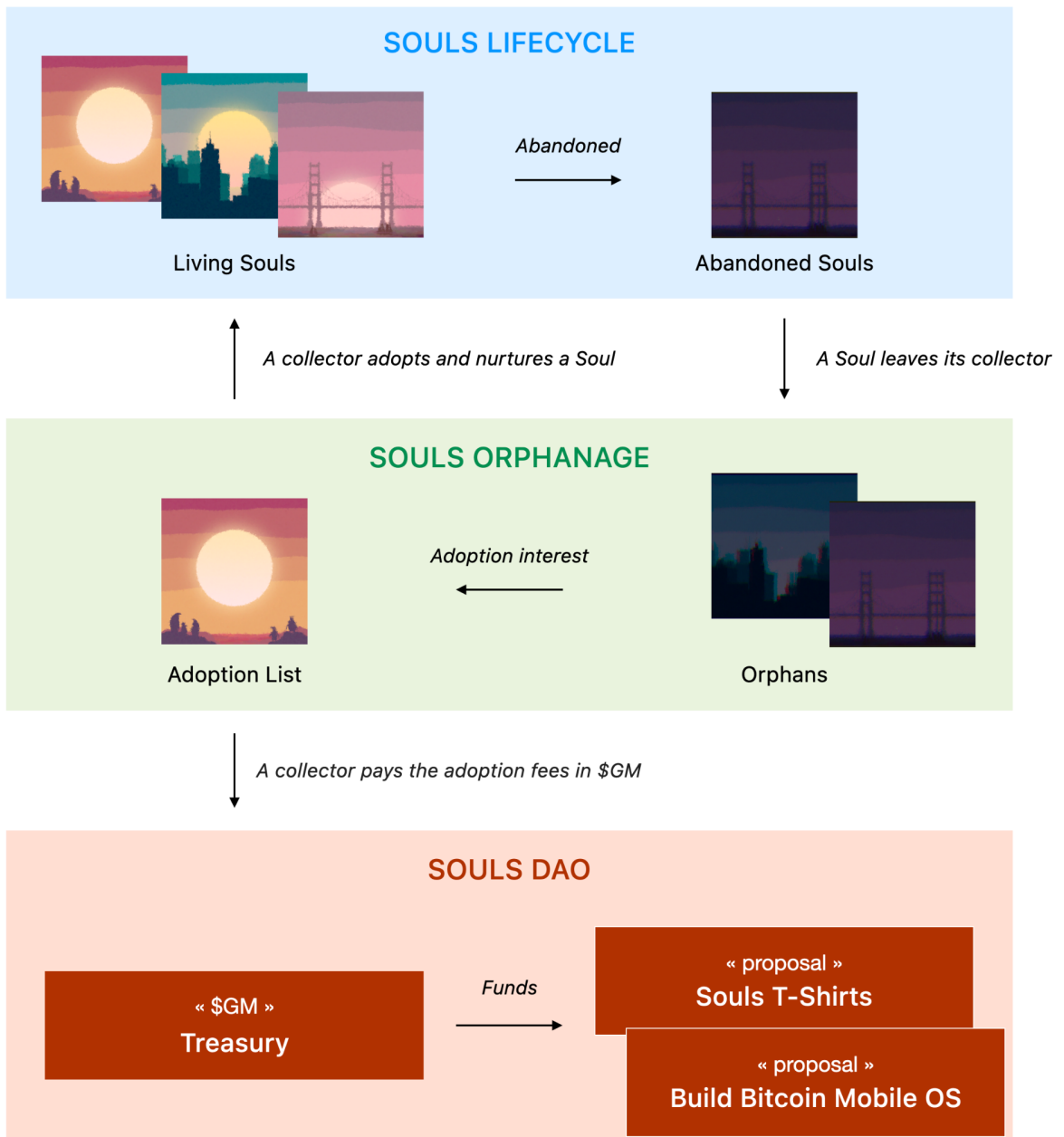
Purpose

The purpose of the Souls protocol is to portray the belief in the future of the Bitcoin network. A future where Bitcoin is vastly more useful than just a speculative currency.

2. The Souls Cryptoart Protocol

The Souls protocol is designed to provide an ever-lasting infrastructure to support the Souls artworks. At the core of the protocol is a set of Solidity smart contracts running on Bitcoin via the Trustless Computer protocol.

These smart contracts act as the central coordinator, orchestrating the interactions between Souls and their collectors. These smart contracts ensure the smooth functioning of the Souls collection, handling interactions such as Souls adoption, Souls visualization, and DAO governance.



The Souls DAO serves as a decentralized governance mechanism, allowing collectors to make decisions and steer the direction of the Souls protocol. Through the DAO, collectors can propose and vote on important matters, including changes to the Soul orphanage rules, community initiatives, and resource allocation.

To provide a user-friendly interface and seamless experience, the Soul system also includes a dedicated website. This website serves as a hub for information about the Souls collection, allowing users to explore, adopt, and interact with Souls. It provides access to the Soul orphanage, where users can browse available Souls, submit adoption proposals, and view their adopted Souls.

The screenshot displays the Soul system website interface. At the top, there are navigation links for 'Story', 'Art', 'Adopt', and 'FAQs'. A search bar and wallet information (30 GM, 2.04 TC, 0.05 BTC) are also visible. A banner reads 'Experience the first ever art protocol powered by smart contracts and \$GM' with an 'Adopt Souls' button.

The main content area is titled 'Souls #23'. It features a 'Live auction' section with a bid list:

Profile	Amount	Time
Ox19c8...9824	15 GM	Jun 12, 2023 at 6:25pm
Ox19c8...9824 (You)	12 GM	Jun 12, 2023 at 6:15pm
Ox19c8...9824	6 GM	Jun 12, 2023 at 5:03pm
Ox19c8...9824	2 GM	Jun 10, 2023 at 9:32pm
Ox19c8...9824	1.6 GM	Jun 10, 2023 at 10:23am
Ox19c8...9824	1.15 GM	Jun 10, 2023 at 8:27am
Ox19c8...9824	1.12 GM	Jun 09, 2023 at 2:27am

The central image shows a Soul artwork: a bright yellow sun in a dark blue sky with a dark foreground. To the right, the 'Attributes' section lists:

- Clouds: Seven (12%)
- Foreground Height: High (50%)
- Color Palette: Windy Twilight (70%)
- Landforms: \$GM Island (2%)

Below the main Soul, a 'More from this collection' section displays four other Soul artworks with their respective highest bids and time remaining:

- Artwork 1: Highest bid 5.5 GM, 1d : 24h : 06m
- Artwork 2: Highest bid 40 GM, 0d : 2h : 12m
- Artwork 3: Highest bid 25 GM, 4d : 32h : 22m
- Artwork 4: Highest bid 12 GM, 6d : 05h : 02m

3. Soul as metaphor



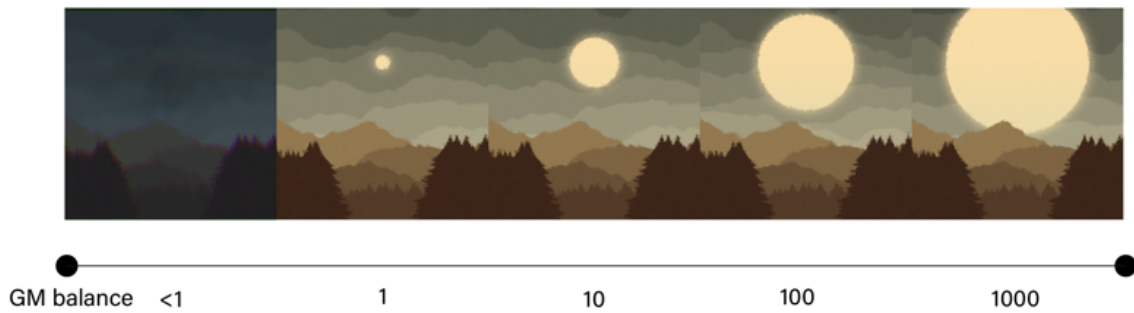
At the heart of the artwork lies a central sun, a radiant symbol that represents each Soul in the collection. The sun not only signifies warmth and light but also carries a deeper metaphorical significance. It echoes the popular phrase "good morning" in the crypto community, alluding to the optimistic spirit and the dawn of a new era.

Just as the sun rises each day, the Souls collection symbolizes hope, resilience, and the potential for growth of the Bitcoin network.

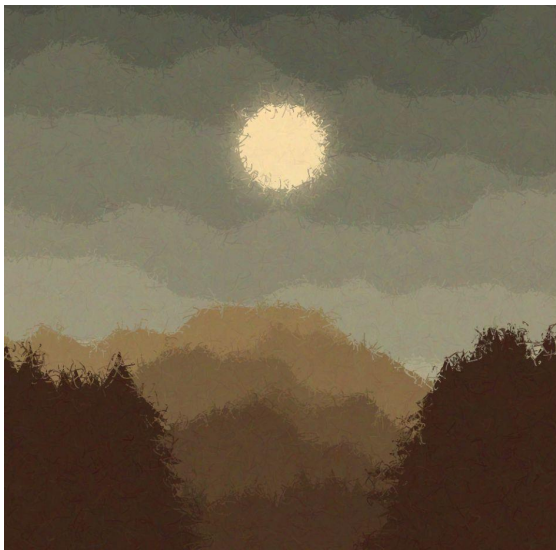
4. It's your soul

The Souls collection introduces a unique and captivating feature that allows each Soul to personalize itself to its collector—forging a dynamic connection between the artwork and the individual's GM tokens.

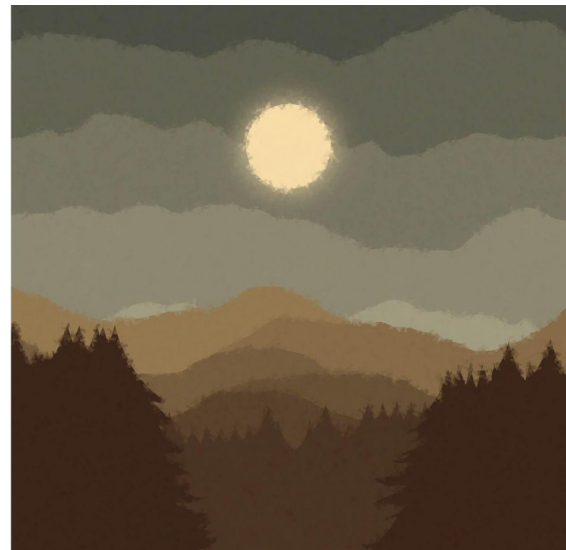
The GM balance held by the collector plays a significant role in shaping the aesthetic and behavior of their Soul. As the collector acquires more GM tokens, the Soul's presence within the artwork expands and evolves. The visual representation of the Soul grows in size, reflecting the accumulation of GM tokens and the strengthening bond between the collector and their Soul.



The brushwork reflects the collector's journey with their GM tokens. As a collector holds onto their GM tokens for an extended period, the brushwork takes on a stable and composed form— mirroring the commitment of the collector. On the other hand, if the collector engages in frequent and fluent trading activities, the brushwork adopts a more wild and expressive nature, embodying the dynamic and adventurous spirit of their trading endeavors.



Active Trader

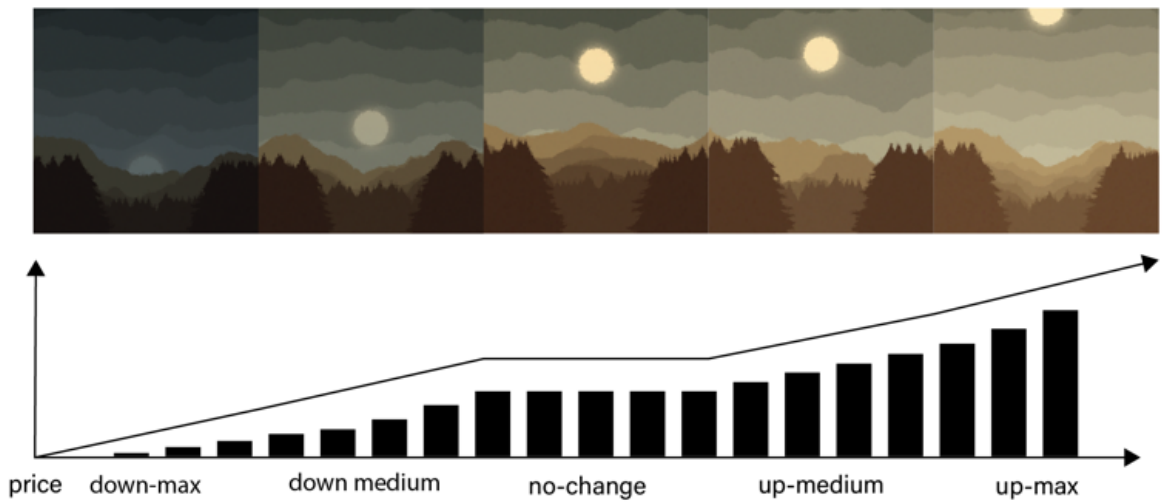


Patient Holder

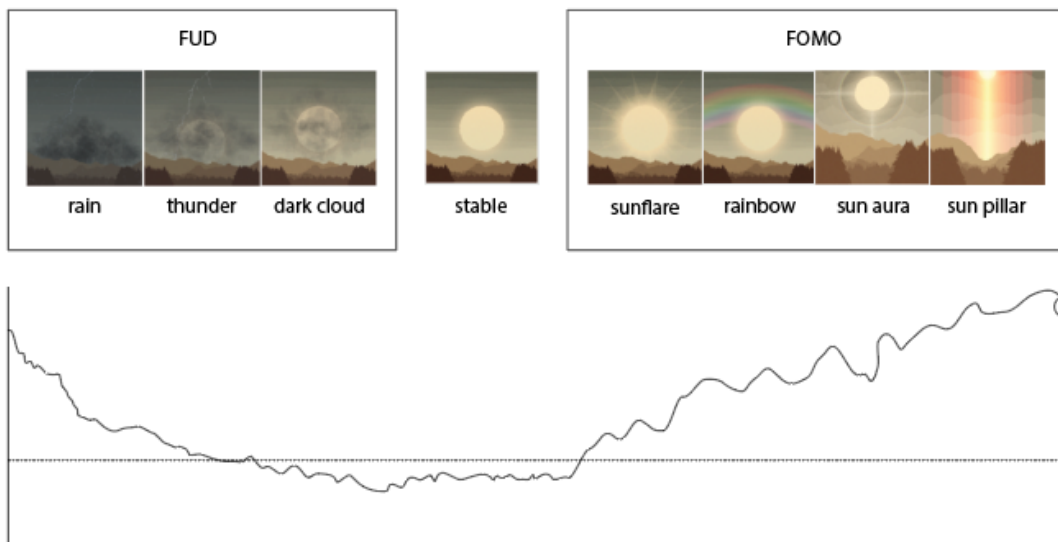
5. We're all in this together

The Souls collection is more than just a static art collection—it is a dynamic and interactive experience that mirrors human behavior. Each Soul within the collection embodies emotions and traits that resonate with individuals on a deep level. Fear, greed, and belief are among the fundamental human behaviors depicted by these souls.

The GM token price and market behavior impact the collection as a whole. When the GM token price rises, the Souls soar higher in the sky, symbolizing the collective optimism and excitement within the community.



The weather in the artwork becomes more vibrant and beautiful, reflecting the FOMO (Fear of Missing Out) sentiment prevalent during bull markets. Conversely, during periods of market uncertainty or fear (FUD), the weather takes on a more turbulent and stormy appearance, mirroring the cautious and apprehensive atmosphere.



6. Souls are soulbound

The Souls collection pioneers a new concept in the art world, introducing the first-ever soulbound art. Unlike traditional art pieces, Souls are non-transferable and intimately linked to their collectors. This unique characteristic adds an element of exclusivity and personal connection to each artwork, creating a profound sense of ownership and attachment.

Ownership of a Soul comes with a responsibility. If a collector neglects their Soul or their GM balance falls below a certain threshold (1GM), after a period of time (7 days), the Soul will leave and go to the Souls orphanage, awaiting adoption by another collector. This mechanism ensures that each Soul finds a caring and committed home, creating a dynamic ecosystem of art enthusiasts and fostering a sense of shared responsibility within the community.



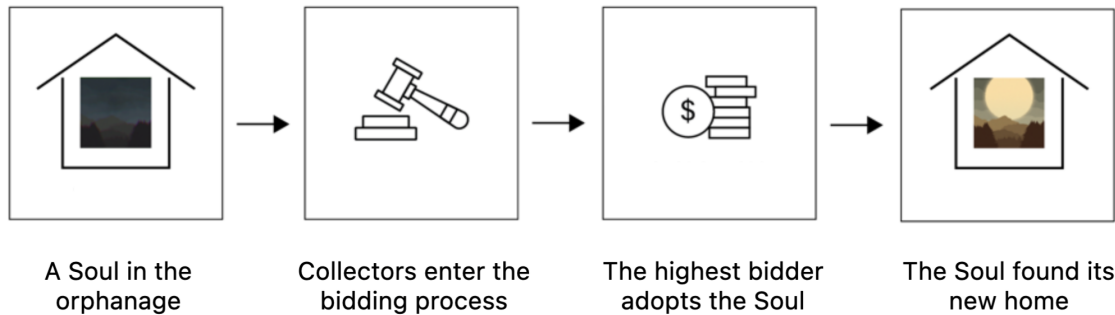
As the sun slowly disappears and the landscape plunges into darkness and digital distortion after 7 days of neglect.

7. The Souls orphanage

To adopt a Soul, interested collectors can participate in a bidding adoption process. Bidders place their adoption bids, competing with others who also seek to provide a loving

home for the same Soul. The bidding process ensures a fair and transparent allocation of Souls, with the highest bid winning the opportunity to adopt the Soul.

90% of the proceeds from the winning bids go to the Souls DAO, reinforcing the financial sustainability and growth of the ecosystem. The remaining 10% of the winning bids go to the Souls team, as royalties.

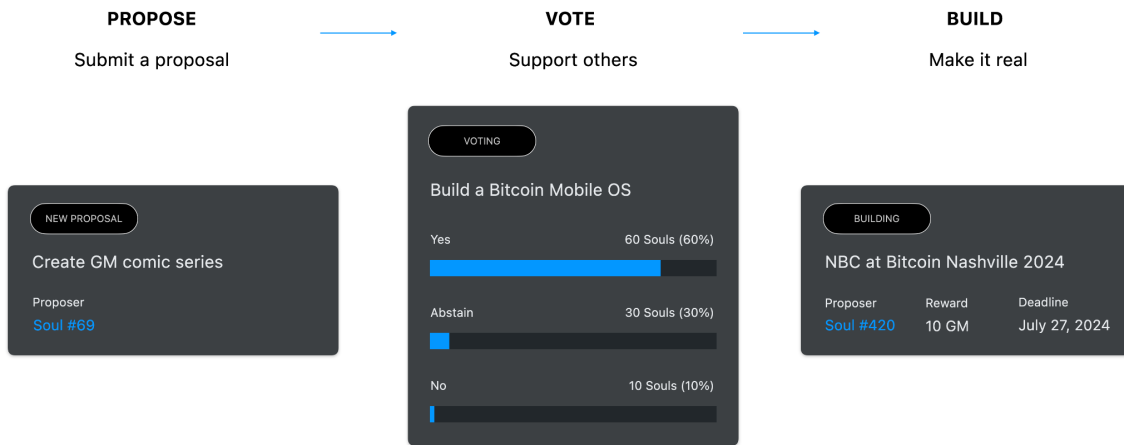


8. Souls DAO

The DAO acts as a collective decision-making entity, enabling the community to actively participate in the development and future direction of the Souls collection. Through the DAO, collectors can propose and vote on various initiatives, including community events, collaborations with artists, and the allocation of funds generated from Souls adoptions.

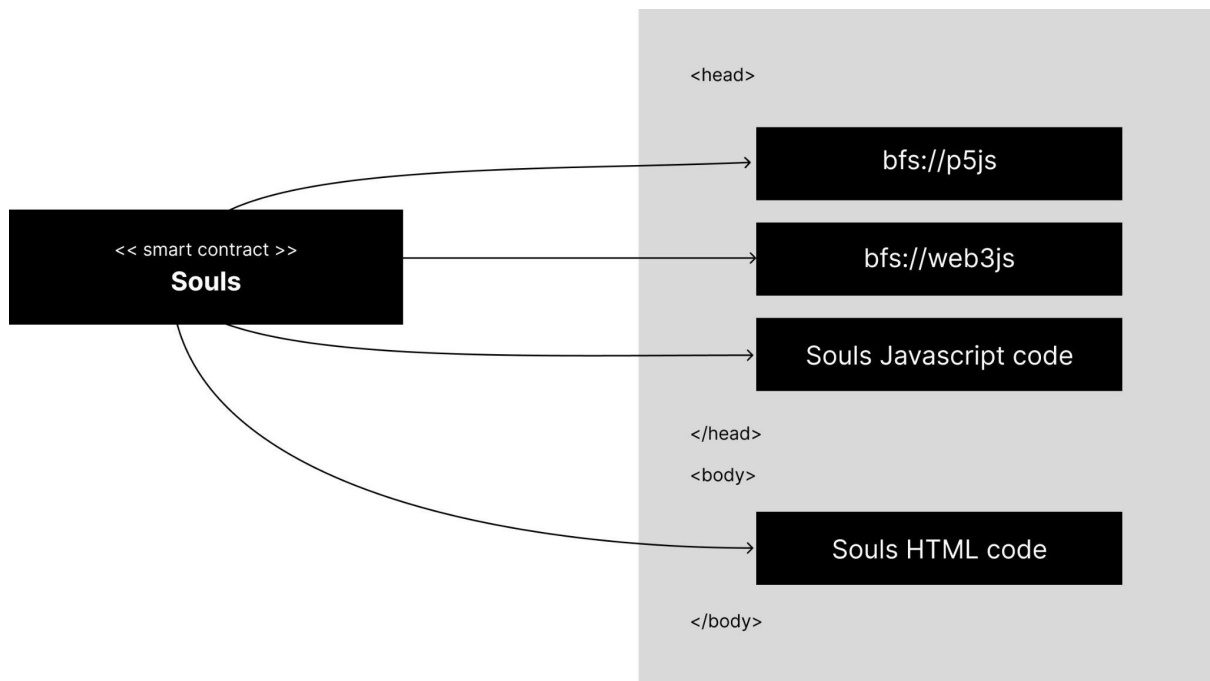
Additionally, the DAO has the power to vote on and adjust protocol variables, such as the GM threshold and the duration of time a Soul remains with a collector. This decentralized decision-making approach ensures that the community has a voice in shaping the rules and parameters that govern the Souls protocol, fostering a sense of ownership and empowerment among all participants.

Souls DAO



9. Souls live on Bitcoin forever

The Souls collection embraces the concept of being fully on-chain, revolutionizing the way digital art is created and shared. At the heart of this innovation is the utilization of on-chain libraries, starting with the integration of the p5.js and web3.js libraries.



The Souls smart contract composes the on-chain p5.js and web3.js libraries within its smart contract code. The p5.js and web3.js libraries are stored on the Bitcoin File System (BFS), which allows easy file linking within a smart contract.

```

function tokenHTML(bytes32 seed, uint256 tokenId) external view returns (string memory result) {
    result = "<html><head>";
    result = string(abi.encodePacked(result, p5jsScript()));
    result = string(abi.encodePacked(result, web3Script()));
    result = string(abi.encodePacked(result, variableScript(seed, tokenId)));
    result = string(abi.encodePacked(result, _script));
}

```

p5.js—a powerful JavaScript library for creative coding—enables artists and creators to express their vision through generative art and interactive visuals. By bringing p5.js onto the Bitcoin blockchain, the Souls collection introduces a new era of artistic possibilities. Artists can utilize the expressive capabilities of p5.js to create unique and captivating generative art, showcasing their creativity and pushing the boundaries of digital art.

```

function p5jsScript() public view returns (string memory result) {
    result = "<script sandbox='allow-scripts' type='text/javascript'>";

    BFS bfs = BFS(_bfs);
    string memory fileName = "p5js@1.5.0.js";
    // count file
    address scriptProvider = IParameterControl(_paramsAddress).getAddress("SCRIPT_PROVIDER");
    uint256 count = bfs.count(scriptProvider, fileName);
    count += 1;
    // load and concat string
    for (uint256 i = 0; i < count; i++) {
        (bytes memory data, int256 nextChunk) = bfs.load(scriptProvider, fileName, i);
        result = string(abi.encodePacked(result, string(data)));
    }
    result = string(abi.encodePacked(result, "</script>"));
    return result;
}

```

But the innovation doesn't stop there. The Souls collection also embraces the power of the Trussless Computer protocol, allowing for the integration of other on-chain libraries in the future. Artists and developers can bring their preferred libraries, such as three.js or other powerful frameworks, onto the Bitcoin blockchain, expanding the creative palette and opening up endless possibilities for future gen-art collections.

10. Every mint is a surprise

Souls implements a random minting process on Bitcoin. The Randomizer smart contract is used to determine Souls traits during the minting process.

Every mint is a thrilling and magical experience—the collector is part of the Souls creation process. Neither the Souls core team or the initial collector know what the output will be at the moment it's collected.

```
pragma solidity ^0.8.0;

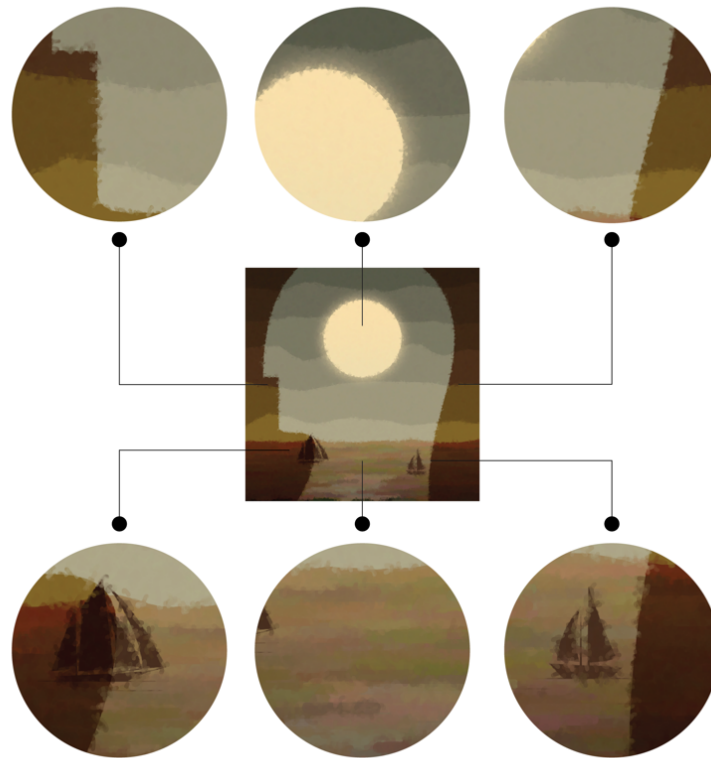
import "@openzeppelin/contracts-upgradeable/access/OwnableUpgradeable.sol";
import "../interfaces/IRandomizer.sol";

contract Randomizer is OwnableUpgradeable, IRandomizer {

    function initialize() initializer public {
        __Ownable_init();
    }

    function generateTokenHash(uint256 tokenId) external virtual override returns (bytes32 tokenHash) {
        tokenHash = keccak256(
            abi.encodePacked(
                tokenId,
                block.number,
                blockhash(block.number - 1),
                block.timestamp
            )
        );
    }
}
```

11. Oil paintings as code



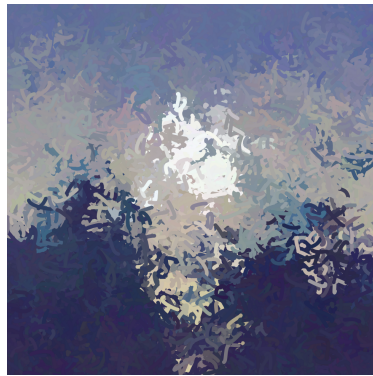
The Souls collection is about expression and symbolism—inviting viewers into an eye-opening world of generative art. Each Soul within the collection presents a unique landscape that evokes emotion and meaning.

The art direction of the Souls collection goes for the look of traditional oil paintings—carefully crafted to imitate the texture and brushwork of classical artworks. Through the innovative use of generative algorithms, each Soul becomes a living masterpiece, dynamically evolving and reacting to its owner.

Here's how it works:



The process begins by sampling the colors of specific pixels from the original drawing. These colors are then used to create a series of curved lines that are placed within the artwork.



The colors of these curved lines shift ever so slightly, adding a rich texture to the overall composition.

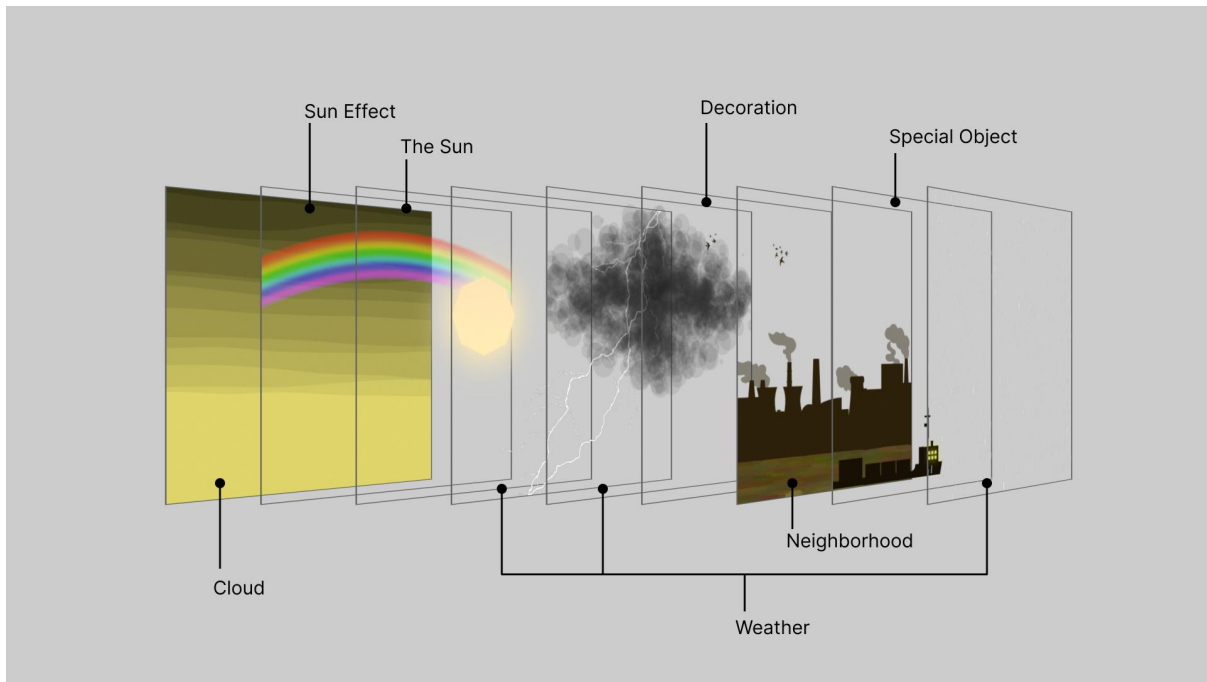


The length and width of these curved lines are adjusted—giving the brush strokes a unique look. This careful movement of curves brings forth the textured and layered appearance of traditional oil paintings.

Here's the drawing function from the artwork source code:

```
function paintingTexture() {
  noFill()
  let colVary
  let textureNum, alpha, rdPos
  textureNum = (max(width, height) / min(width, height)) * 30000
  strokeWeight(4)
  alpha = 100
  rdPos = 7
  colVary = 2

  colorMode(RGB)
  for (let i = 0; i < textureNum; i++) {
    const x = random(width)
    const y = random(height)
    let col = get(x, y)
    stroke(
      col[0] + random(-colVary, colVary),
      col[1] + random(-colVary, colVary),
      col[2] + random(-colVary, colVary),
      alpha
    )
    push()
    translate(x, y)
    rotate(random(PI * 2))
    curve(
      random(-rdPos, rdPos),
      0,
      0,
      random(-rdPos, rdPos),
      random(-rdPos, rdPos),
      random(-rdPos, rdPos),
      random(rdPos, rdPos * 4),
      random(-rdPos, rdPos)
    )
    pop()
  }
}
```



In the creation of the base drawing, a combination of 4 to 12 layers is meticulously crafted, with each layer contributing to the overall visual composition. The layers that make up the base drawing include:

- **Cloud:** The cloud layer adds a sense of atmosphere to the artwork. The shape, density, and arrangement of the clouds are carefully designed to evoke a specific mood or aesthetic.
- **The Sun:** The sun layer serves as the focal point of the artwork, radiating warmth and light. Its position, size, and color are thoughtfully determined to create a visually appealing and harmonious balance.
- **Weather and Sun Effects:** Additional layers are introduced to weather conditions and sun-related effects. These layers may include storm clouds, raindrops, rainbows, sun flares, and sun pillars, etc.
- **Neighborhood:** The neighborhood layer showcases a specific landscape from the new Bitcoin city, providing a sense of place and identity to the artwork. This layer may feature buildings, streets, trees, or other architectural and natural elements, adding depth and context to the composition.
- **Decoration:** This layer adds delightful details to the sky, including birds, planes, helicopters, balloons, etc. These elements enhance the sense of movement and wonder.

- **Special Objects:** Each neighborhood boasts its own unique elements, such as whales beneath the Nakamoto Bridge or ships in the industry zone, adding character and depth to the artwork.

All of these layers are programmatically generated using p5.js code. Every layer within the artwork is distinct—ensuring that no two layers are exactly alike throughout the entire collection.

The colors of each layer stick to a carefully selected color palette, creating a cohesive visual experience. The contrast between the layers is meticulously adjusted to achieve separation and depth, enhancing the overall appeal of the artwork.

Souls is responsive



The Souls artworks offer a unique and immersive experience that can be enjoyed in various aspect ratios, allowing viewers to explore and perceive the artwork in different ways. By experimenting with different screen dimensions and aspect ratios, viewers can unlock new perspectives and uncover hidden details within the composition.

12. Additional features unlock for top holders

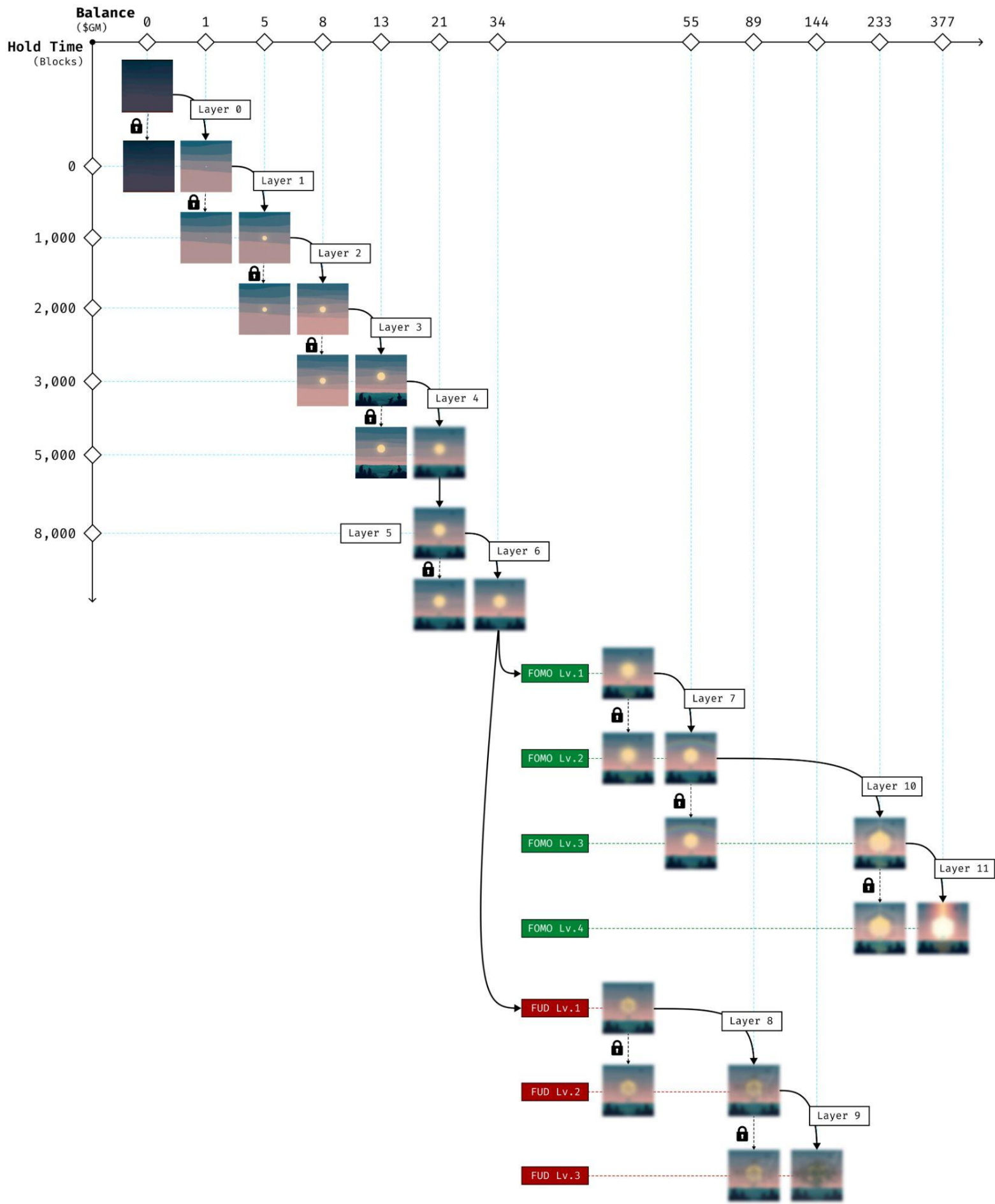
As a thank you for the support and dedication from our top holders, the Souls collection introduces a series of exclusive features that enhance the artistic journey. As top holders accumulate and hold large amounts of GM tokens, new dimensions of innovation and personalization are unlocked.

With these additional features, top holders have the ability to shape their soul's expression in new ways. For instance, top holders unlock a more diverse palette that changes the color of the sun, creating a new visual spectrum. Also, the layers of clouds will evolve — expanding the artistic depth of the artwork. And the foreground reveals glimpses of the landscapes found within the New Bitcoin City, giving the artwork a sense of time and place.

Plus, even more rewards are in store for top holders as they continue to reach Bitcoin block milestones. Decorative elements such as birds, airplanes, and other eye-catching objects animate the artwork, adding a touch of whimsy to each piece. Every milestone brings creative potential, empowering top holders to shape the sun into different forms, and in turn, intensifying its aura. The artistic canvas shines with colorful rainbows, thunder, rain, and a vibrant sun pillar effect—orchestrating a symphony of colors, sounds, and textures that stir the senses.

It's important to note that the unlocking of these features is tied to the block time of the soul and owners must acquire a certain amount of GM tokens to make these features visible. With each new milestone reached and feature unlocked, the Souls collection underscores the dedication and creativity of its owners.

Sample journey for achieving milestones



13. Traits

Color palettes



Dark Cosmic
(0.57%)



Kimono
(0.8%)



Holy Grail
(0.97%)



Ragnarök
(1.29%)



Werewolf
(1.29%)



Desolate Ember
(1.29%)



Mona Lisa
(1.54%)



Starry Night
(2.99%)



RBY
(3.07%)



Lucid Dream
(3.4%)



Luminous Eternals
(3.64%)



Amber
(3.31%)



XMB
(3.64%)



Wild Blue Yonder
(3.48%)



Purple Bliss
(3.88%)



Sapphire
(3.64%)



Avocado
(4.28%)



Chestnut
(4.28%)



Savanna
(4.28%)



Sweet Sugar
(5.01%)



Maroon Flush
(4.28%)



Pinkeach
(4.12%)



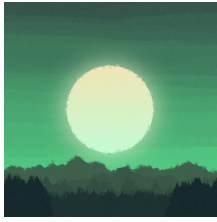
Coastal Oasis
(4.45%)



Golden Meadow
(4.28%)



Celestial Pulse
(3.88%)



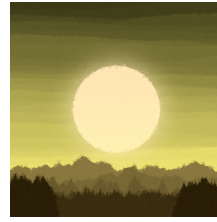
Flips
(4.37%)



Fiery Passion
(4.04%)



Deep Saffron
(5.17%)



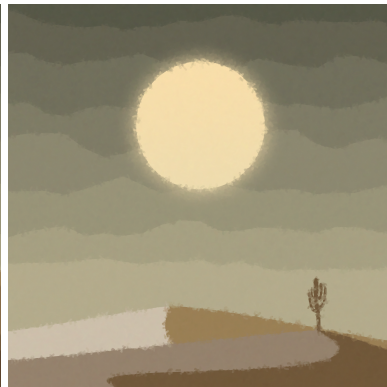
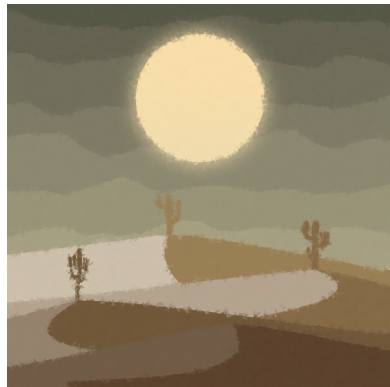
Wanderer
(4.04%)



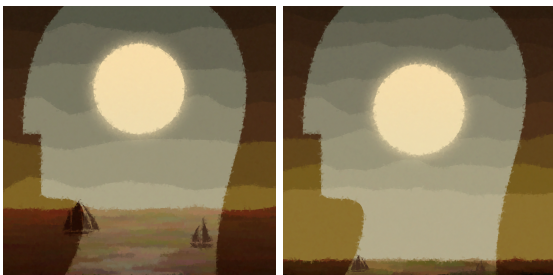
Autumn Harvest
(4.69%)

Horizon line & Neighborhoods

Horizon line determines the level of the land and sea within the visual landscape. It represents the boundary where the sky meets the earth, creating a sense of perspective and depth in the artwork. There are 2 options: High (33%), Low (66%)



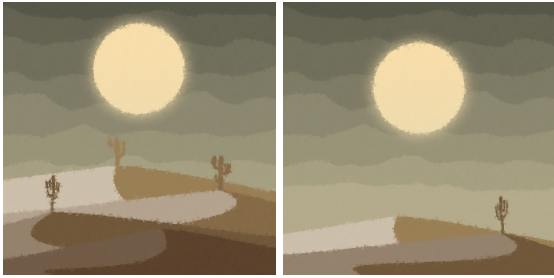
Neighborhoods in the Souls artwork collection represents distinct areas within the New Bitcoin City landscape. Each neighborhood showcases a unique environment and architectural style, reflecting the diverse and vibrant nature of the city.



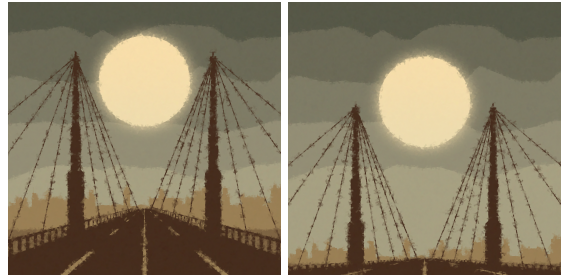
Al Square (1.68%)



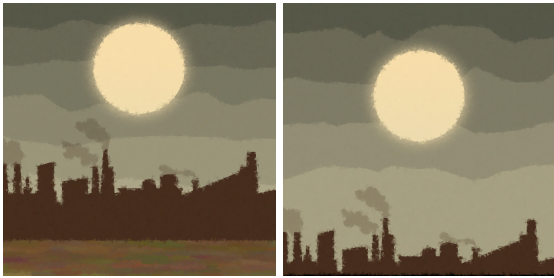
Nakamoto Village (3.03%)



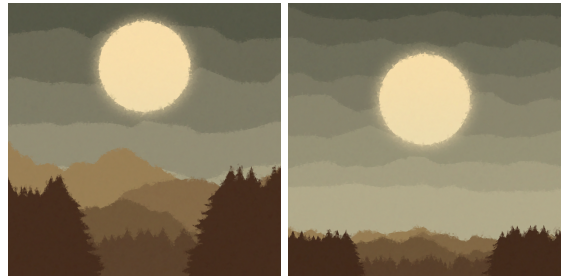
Inscription Village (4.04%)



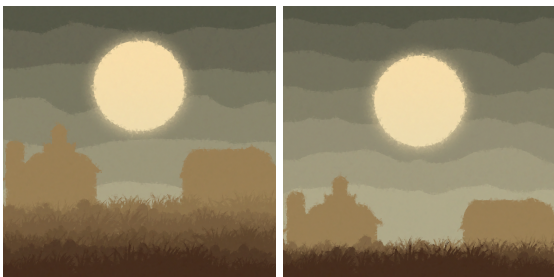
Vitaliz Bridge (5.39%)



Industry Zone (9.43%)



GameFi Garden (10,77%)



Generative Art Village (18.18%)

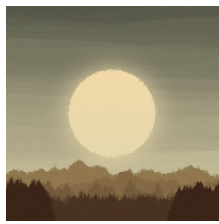


\$GM Island (23.23%)



DeFi District (24.24%)

Sky extras



Clear sky
(1.92%)



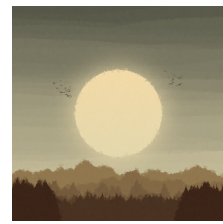
Air Balloon
(5.77%)



Helicopter
(12.31%)






Airplane
(26.15%)



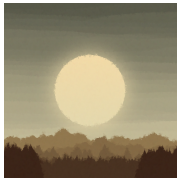
Bird
(53.85%)



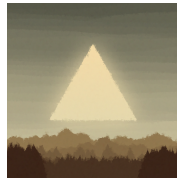
Ground surprises

<p>No, thanks (15%)</p>			
<p>Yes! (85%)</p>			
			
			

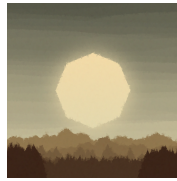
Sun Morphing



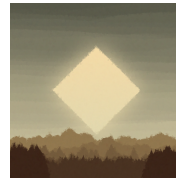
Round
(1.56%)



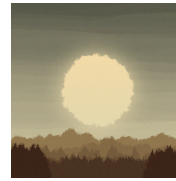
Triangle
(4.98%)



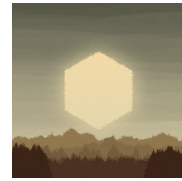
Octagon
(9.35%)



Diamond
(18.69%)



Shapeless
(24.92%)



Hexagon
(40.5%)

Generative Rates

10 Minutes - 5.15%

1 Hour - 12.37%

1 Day - 53.6%

1 Week - 28.87%

Memory

1000 Blocks - 7.74%

2000 Blocks - 16.77%

3000 Blocks - 32.9%

4000 Blocks - 42.5%