

Password Chaos

The evolving NFT project from Gimbalabs

Version 2.1 | 19 December 2021

While the Web2 was a front-end revolution, the Web3 is a backend revolution, introducing a universal state layer. It is a set of protocols led by a blockchain network or similar distributed ledger, which intends to reinvent how the Internet is wired in the backend.

Token Economy, Shermin Voshmgir

The unprecedented is necessarily unrecognizable. When we encounter something unprecedented, we automatically interpret it through the lens of familiar categories, thereby rendering invisible precisely that which is unprecedented. This is how the unprecedented reliably confounds understanding; existing lenses illuminate the familiar, thus obscuring the original by turning the unprecedented into an extension of the past.

The Age of Surveillance Capitalism, Shoshana Zuboff

The Evolution of NFTs

Password Chaos is an evolving NFT project built to drive community education, and it is the first NFT release from Gimbalabs. In this paper, we outline how Password Chaos is built as a framework for people to learn more about what Cardano is, how it works, and what it can do.

Gimbalabs was founded in October, 2020. Our goals are to build distributed, open-source tools for building on Cardano, and to create an open community where anyone can learn how to use these tools. Everything we share in this paper incorporates what we've learned so far in the ongoing development of technical, educational, and community infrastructure. This paper will be accompanied by videos and community meetings aimed at making these ideas as accessible as possible.

We are building Password Chaos because we know that we're still early in the story of what blockchain technology will ultimately be, and because we understand that art is a powerful launching point for embarking on the next part of a shared journey.

This paper is an invitation to join us.

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If you're short on time, make sure to give the Concepts section a quick read. When you want to go deeper, check out the Mechanics section. If you'd like to join us on the journey — and hold us accountable to it — be sure to read through the Outcomes section to get an idea of what we intend to achieve. Finally, if you have feedback, please don't hesitate to share it: over time, we'll revise this paper to align with the evolution of Password Chaos.

I. Concepts

By implementing pricing mechanics and series population mechanics that change according to prior results, we have designed Password Chaos to evolve organically, last for as long there is interest, and to create new opportunities for learning, research, and community development.

The exact parameters of each Password Chaos Series will depend on the results from the sale of the previous Series. Every time a Series ends, we'll announce the release date of the next one.

Why did we build Password Chaos this way? As we started to discuss what Password Chaos would be, we kept coming back to the following five concepts:

- i. The "new Internet" will be **familiar, yet different**
- ii. A blockchain project only has value if people use it, and network effects rely on **interactive population growth**
- iii. Some things don't need to exist, and market dynamics should ensure that **extinction is possible**
- iv. People learn best through **shared experience**
- v. The primary use case for NFTs is **art, but only for now**

Here is an overview of how we're thinking about these concepts in the context of Password Chaos.

i. Familiar, Yet Different

The Internet is changing. We're in the story, and we don't know exactly how it's going to play out. We're experiencing the internet through familiar front-ends and UX design patterns, even as it starts to *feel* different. Web pages look pretty much the same, but we're interacting differently with people. We're trusting and collaborating in new ways.

Password Chaos is a celebration that we are *here, now*. We are working, together, and staying open minded to what might come.

Password Chaos joins the NFT conversation by starting with art, and envisioning what's next. We start with two problems that most users of the Internet understand:

1. It is hard to keep track of usernames and passwords in their current form.
2. Our data is owned by private companies on private servers around the world.

The real revolution of blockchain, "Web3", and tokenomics — including both NFTs and fungible tokens — will not always be immediately apparent to end users. This revolution will change the questions we can ask, and the meaning that can emerge, when participating in our global network. The way we think about data storage, ownership, authentication, and access will all lead to fundamentally different sorts of applications, even when most of what is new is not immediately apparent in the UI.

ii. Interactive Population Growth

We don't know how long the "Art NFT" market will sustain its current value. We embrace the unknown by allowing the number of NFTs minted in each Password Chaos Series, and the rarity distribution within each Series, to change organically over time.

We use the word "Series" to represent a "generation" of Password Chaos NFTs, and we use the [logistic map](#) to determine how the number of NFTs minted changes from one Series to the next.

The logistic map is represented by this formula:

$$x_{n+1} = r x_n(1 - x_n)$$

Where:

- x_n represents the percentage of some maximum population in one generation of a population
- x_{n+1} represents the percentage of that maximum population in the next generation
- r represents a reproductive rate for the population from one generation to the next

In short, the number of NFTs in any given Series is based on

1. The edition size of the previous Series
2. How quickly the previous Series sold out.

We also allow the relative rarity of certain properties within each Series to be an emergent property, and here too the data from one Series are used to design the next. Of course, there's a lot more to share about all of this! For a deep dive into Population and Rarity Mechanics, see the Mechanics section.

iii. Extinction is Possible

If there's no reason for someone to buy a Password Chaos NFT, then there will be no more.

Every Series Password Chaos will be offered for a maximum of one moon period, which is equivalent to almost four weeks. Or to the nearest minute, that's 27 days, 7 hours, and 44 minutes. Series #1 of Password will be sold starting at 07:43 UTC on 4 December, 2021, and must sell out before 15:27 UTC on 31 December, 2021.

If a Password Chaos series does not sell out within one moon period, then no more NFTs will be minted.

iv. Shared Experience

We're all learning together as we confront the unprecedented. Gimbalabs provides opportunities for people to share the experience of discovering what is newly possible. We are committed to building new tools and open spaces for people to get together, learn, and develop ideas.

You can see examples in:

- The Dandelion Incentivized Alpha Network
- Plutus Project-Based Learning
- Gimbalabs Playground Sessions
- Cardano Starter Kits
- Conversations across the Gimbalabs Discord server

Owners of Password Chaos NFTs will join the Gimbalabs community of developers, builders, and entrepreneurs in the opportunity to test new tools and and share new ideas.

We'll also encounter new data together, and share the experience of seeing how the project evolves. As you'll see in the Mechanics section of this paper, we'll use data to design each successive series of Password Chaos. Beyond that, what additional utility will we discover? What data will have value? Who should own it? We're eager to follow these lines of inquiry, along with anyone who wants to join in.

v. Art, For Now

Right now, there's a vibrant community creating shared understanding of Cardano through the lens of art NFTs, and at Gimbalabs, we're in development mode. We're building a bridge between what is and will be by offering art NFTs that show you are here, when new rails are being built, as an early supporter of Gimbalabs.

But it's only a place to start.

Since the founding of Gimbalabs, we have been learning how to build technical, educational and community infrastructure that makes it possible for more people to understand what Cardano is and what it can do. Password Chaos is a tool for the journey.

With time, successive drops will provide examples of what we're learning along the way. The mechanics described below provide a framework for organizing this knowledge in the context of an NFT project. Together with our community, we will continue to explore new mechanisms for adding value for art-NFT projects; new forms of utility for unique non-art tokens; new sorts of analytics; and on-chain peeks into other projects at Gimbalabs.

What any blockchain or blockchain project comes to be is only the result of collaboration. The body of work created here will track the evolution of how people come together to recognize—and eventually embrace—the utility of these new problem solving tools.

II. Mechanics

As outlined above, Password Chaos will change over time. The art, the algorithms, the inputs to those algorithms, and most importantly, the functionality of Password Chaos NFTs will evolve from one series to the next. In the following sections, we'll take a detailed look at some of these mechanics.

First, we discuss Population Mechanics, or the way the number of NFTs minted in Password Chaos will change from one Series to the next. Next, we look at how data will be used in the Rarity Mechanics that are used to compose each Series. Then, we discuss Pricing Mechanics, or the way the selling price of Password Chaos NFTs will change over the course of each drop. We finish up by discussing how Password Chaos will evolve over time.

i. Population Mechanics

If you looked at our overview of "Interactive Population Growth" above, we hope that you have some questions. For example, what do we mean by the "maximum population"?

Maximum population is a project parameter, and it is set to 1000. As you'll see in this section, it's unlikely that there will ever be 1000 NFTs minted at once. (In fact, if that ever happens, then Password Chaos will "go extinct".) To help you see why, this section provides background on how parameter values will change over time.

In all, there are five values we'll want to notice:

- the maximum population, P , (in biology this is called the *carrying capacity*) of our ecosystem
- the length of time t for one "generation" to pass to the next
- an iterator n , which represents the number of a Password Chaos Series
- x_n : the number of NFTs minted in Series n , as a percentage of the carrying capacity P
- r_n : the population growth rate from Series n to Series $n+1$

Before we take a look at how these values work, we strongly recommend watching [this video from Veritaseum, which provides a great intro to the Logistic Map](#).

The Logistic Map

The [logistic map](#) is used in biology as a model of how populations change over time. Here are the two key ideas:

1. Every environment can sustain a certain amount of life. In biology, this is called *carrying capacity*, and can be illustrated by thinking about a forest with food for this many deer, or a field with room for that many dandelions.
 - When populations are much lower than the carrying capacity of their environment, they may grow quickly.
 - When populations meet or exceed the carrying capacity of their environment, this can lead to environmental degradation, and ultimately a decrease in population.
2. What actually happens all depends on the *growth rate* of a species.
 - A very low growth rate will eventually lead to extinction;
 - A moderate growth rate will often lead to predictability;
 - And if the growth rate is high — *almost too high, but not quite* — that leads to chaos.

We use the logistic map equation to determine the number of NFTs in each Series of Password Chaos. Written as an equation, the logistic map looks like this:

$$x_{n+1} = r x_n(1 - x_n)$$

Here, you can see three of the values outlined above: n , x_n , and r . Remember that:

- n represents the Series #
- x_n represents the population of Series n , as the percentage of the max. population P
- r represents the growth rate from Series n to Series $n+1$

What we don't see in the equation are P , and t , the length of time for one generation to pass to the next. Both of these values are set as project parameters.

Carrying Capacity (P)

We have chosen to set the carrying capacity, P , to 1000. This means, for example, that if x_3 is 0.5, (or 50%), then 500 NFTs will be minted in Series 3. If x_8 is 0.096 (9.6%), then 96 NFTs will be minted in Series 8.

Maximum Time (t)

Every Password Chaos Series will be offered for sale for a maximum of one moon period, which is equivalent to a little less than four weeks. A bit more precisely, one moon cycle is equal to approximately 39,344 minutes, which is equal to approximately 27.322 days, or approximately 3.903 weeks.

Dynamic Growth Rate (r_n)

This is where we add a special twist. In our model, the value of the reproductive rate r changes with each Series. When the value of r is in between 0 and 4, some interesting population dynamics emerge. By measuring time in weeks, we now have the ability to use the time remaining in the sale period of drop n to define a value r_n , that is in the range 0 to 4. The value r_n is the growth rate from Series n to Series $n+1$.

An example can help to put it all together:

Suppose that there are 100 NFTs offered in Series 1 of Password Chaos. Therefore, we'd have:

$$x_1 = 100/1000 = 0.1$$

Now suppose that all 100 NFTs are sold within exactly one week. This would mean that 2.903 weeks remained in the selling period for Series 1 when it sold out. Therefore, r_1 would be 2.903, which would yield the following:

$$x_2 = r_1 x_1 (1 - x_1)$$

$$x_2 = 2.903 * (0.1) * (1 - 0.1) = 2.903 * 0.1 * 0.9 = .261$$

Now we take .261, or 26.1% of P , which is set at 1000. This means that there would be 261 NFTs issued in Password Chaos Series #2.

We specify r_n for each drop, rather than some constant value r . The faster a series sells out, the higher the growth rate will be. When a series takes a long time to sell out, the value of r_n will be low, and so will the number of NFTs in Series $n+1$.

If the first few Series sell out quickly, then the number of NFTs in each will grow closer to the carrying capacity of 1000 NFTs. If this continues, however, there will be an element of chaos. When the value of r_n is greater than 3.54 or so, then resulting population numbers oscillate. This behavior will lend a degree of "chaos" to the resulting numbers of NFTs in each series. We'll share more examples of these mechanics in a video to accompany this paper.

"Population" of Series 1

To summarize what we've seen so far: the carrying capacity and generation period are set as project parameters. The growth rate and population size are dynamic and dependent upon the outcomes of successive NFT sales. There's one question we haven't covered: how will we decide how many NFTs to mint in Password Chaos Series #1?

We answered this question by taking it to our community. On 21 November, 2021, we posted a message in Discord introducing the project, and asked everyone to indicate their interest. Thirty community members did so, and therefore the number of NFTs minted in Series 1 will be 30. This means that $x_1 = 0.03$.

ii. Rarity Mechanics

NFT Art creates a playground for data. The relative rarity of different features of digital art creates relative scarcity, which leads to new questions, which lead to the sorts of conversations around which communities can form. We're excited to participate as these dynamics take root.

Building upon the population mechanics described above, the rarity mechanics within each Series will depend on outcomes from the previous Series.

About the Art

To help you understand how rarity works, we'll need to tell you just a bit about the art we've made to launch this project. We're using machine learning to generate images that are "familiar, yet different," by using a process called [Neural Style Transfer](#).

Neural Style Transfer refers to the process of training a neural network how to transform "content images" by applying styles from other "styling images". For example, you could use Neural Style Transfer to make your own selfie look like it was painted by Vincent Van Gogh. It sounds simple, but machine learning is fickle: we've been guiding our neural networks to "learn" just the right amount, and to apply styles appropriately.

The outcomes of the process are a form of "proof of work", and we've build a set of models that we're excited to share with you. For Series 1, we collected a set of images of fire from our community, to represent how we're all gathering together, and soon, burning our passwords.

Our team selected five models to compose Series 1 of Password Chaos. We then applied the five different models to all of our fire photos, and selected 18 of our favorite results from each model. These images comprise the "Pool" from which the first Series of NFTs will be minted. But we won't actually mint all of them – that's up to everyone who buys them.

Image Pool Size > Population Size

In every Password Chaos Series, there will be more images available than will ultimately exist. For Password Chaos Series 1, we've prepared an image library that is three times the size of the Series Population size, for a total of 90 images. Every time someone buys a Password Chaos NFT, they'll be presented with four images from the remaining image pool, and will get to choose one.

Only the images that sell will be minted, so choose carefully. If you don't select an image, there's a chance that it will never exist.

Determined by Community

We don't know exactly which images will sell, so we can't yet tell you about the "relative rarity" of each algorithmic model. We'll only know the final makeup of Series 1 after it sells out.

At the conclusion of Series 1, we'll use the resulting data to construct the Image Pool for Series 2. The percentage of images using each model in the new Pool will be proportional to the results of Series 1. Over time, we'll add new models, suggest new themes for the library of content images, and soon, give people the opportunity to bring their own images to the party.

Changing Over Time

Relative rarity mechanics will continue to be determined by the results of prior drops, and soon, by community input. Over time, there's a lot that we'd like to experiment with. Whenever a new Series is released, we'll revise this paper with the latest data, and details of what's next. We are also collecting data on how often each image is presented, but not selected, by NFT buyers, and we'll look for ways to incorporate data points like this into future dynamics.

iii. Pricing Mechanics

Within the sales period of each Password Chaos Series, the price of the NFTs will change with time. As our team pursues the research & development outcomes of this project, we will explore different pricing functions.

We start simply, with a pricing model that decreases at a linear rate. In Password Chaos Series #1, the starting price of each NFT will be 100 ada. Series #1 of Password will be sold starting at 07:43 UTC on 4 December, 2021. From that time, the price will decrease at a rate of 0.125 ada per hour for the entire length of the drop. Written as a formula:

Let h = number of hours since 0743 UTC on 2021-12-04.

The Cost C of one NFT will be:

$$C(h) = 100 - .125h$$

Given that the length of one moon period is approximately 655 hours, we can see that at the very end of the sales period for Password Chaos (on 31 December, 2021), the price of one NFT will be:

$$C(655) = 100 - .125(655) = 18.125 \text{ ada}$$

So when will a Series sell out? If price is a function of time, and if it takes a long time for a series to sell out, then that means fewer NFTs in next Series. How quickly will that drop sell out? What will that mean for the next one, and so on? Will we see an equilibrium emerge, or will the population of series oscillate, chaotically?

There's only one way to find out — can you tell that we're excited to see what happens?

With the release of each Series, we'll release a revision of this paper sharing sales data, analyzing the results, and looking ahead to what's next.

II.iv Evolution Mechanics

The population, rarity, and pricing dynamics described above are built to create an evolving system. What are some other ways that we can talk about the evolution of Password Chaos?

We're building Password Chaos as a framework that will evolve over time. In addition to growing utility, we'll use Password Chaos to create new opportunities for community engagement. The ideas presented here provide entry points for people to think about bigger ones. Population and pricing mechanics are illustrations that can be extended to a general understanding of bonding curves, and the emergent decision making explored here provides an entry point to thinking about DAO management. We hope you'll join us as we continue to explore all of these ideas in the months to come.

Evolution of Authentication

As the name of this NFT project suggests, we'll start with access. We know that NFTs will provide an alternative to password-based authentication, and as we move beyond the initial "art, for now" stage of Password Chaos, we'll begin to include prototypes of authentication tokens that grant early-access to other Gimbalabs projects.

Evolution of Password Chaos Data + Its Ownership

We don't know what will happen with Password Chaos: how much will the NFTs ultimately sell for? How quickly will they sell out? How many will there be in the next drop? What sorts of models should we use, and with what frequency?

All of these question will be answered with data produced by each Series. So who should own this data? Who should have access to it, and under what conditions?

Data rights are at the core of why we're building a new internet. When we talk about user authentication systems, we're also talking about access to data. We don't claim that this particular data will have too much value, but we'll use it to create a sandbox where we can talk about what we learn from the data, and together, build an informed view on how data might be managed in the new Web3 ecosystem.

Evolution of Reporting and Revisions

With each Series of Password Chaos, we'll release an update of this paper. We'll report on the data from each completed drop, and we'll show how it results in the parameters for the newest drop. We also rely on your feedback. If there is something in this paper that is unclear, too idealistic, or otherwise, please let us know: you'll see the results in the next version of this paper.

III. Outcomes

To summarize, how will we assess the success of Password Chaos? We know that we want to build community, provide educational resources, create space for research and development, and to build a treasury that can help fund all of that work. Here is the initial list of outcomes we're tracking for this project:

1. **Education:** We're calling the project Password Chaos because passwords are a great place to start telling a story of NFTs that extends beyond art. If this project is successful, more people will understand more about the practical applications of NFTs on Cardano. We will measure success anecdotally, and on community engagement metrics.
2. **Community building:** We want to have some fun and celebrate a bit. Building infrastructure is a long-term project, it can be hard to stay motivated, and we need to keep the bigger picture in mind. If this project is successful, it will help to bring people together in recognition of this moment. We will measure the amount of participation in each Series and the quality of that participation in terms of who recognizes new questions, leads new conversations, and ultimately, who builds upon this work.
3. **Piloting research & development:** People learn best through real-world experience, and Password Chaos is designed to create spaces where people can learn first-hand through applied proofs of concept; new NFT data frameworks; and new sorts of interactions. If this project is successful, it will yield new ideas that are ready for further application. We will assess success by looking at when new features are added to Password Chaos, and the level to which project results provide value for other work at Gimbalabs.
4. **Funding for future work:** We want to fund developers to continue their most important work. If this project is successful, we'll be able to do so. Treasury growth is easy to measure; making sure that funds are deployed well is a core challenge of building DAOs.

If we've learned anything from the first year of Gimbalabs, it's that we don't know exactly what we'll learn next, so we also emphasize the "unknown" outcomes: everything we can't predict in an evolving system. We're keeping our hearts and minds open as we encounter the unprecedented.

IV. Results & Reporting

Series 1: "Gather around the fire"

There was certainly some chaos during the drop of Password Chaos Series 1! Thanks for gathering around the fire with us. Let's talk about a few of the things that went wrong first, and then we'll run the numbers for Series 1.

The Series 1 drop was our first chance to put some new systems to the test, and all in all, we are happy with the results. Whenever someone purchased an NFT, they got one, and funds were safe at all times. When things did go wrong, it all had to do with:

- a. Querying data about newly minted NFTs to present to buyers: in most cases, when a Series 1 NFT was minted, our system was unable to show it to the buyer directly on passwordchaos.io. We are working to build better infrastructure for Dapp builders, and although we would have preferred a better outcome, this validated our hypotheses about our top development priorities.
- b. Our brand new system for in-the-moment minting of NFTs, which we'll continue to roll out over the next few drops. Here's a quick overview:

No Password Chaos NFTs are minted in advance, and they don't really "exist" until a buyer makes some decision about what will be included in that NFT. For now, we're testing our new system by allowing buyers to choose one of four images from which to create a new NFT. This functionality is important because if we're talking about passwords and user authentication, we're going to need the ability to include information on credentials "in the moment".

And in our first run of this new platform, it *almost* worked! There were a few unplanned results along the way:

- PasswordChaosS1N12 and PasswordChaosS1N19 were not minted: these two numbers were skipped over in our system, and we decided to commemorate this error by never minting these.
- PasswordChaosS1N11, PasswordChaosS1N15, PasswordChaosS1N18 were each minted twice.
- The "Nova" model snuck in! A couple of our test images found their way into the Image Pool, and in two cases, people bought them. We think of these kind of like [that Billy Ripken baseball card from 1989](#).

Even as we had to pause the drop to fix our database, we didn't stop the price function from decreasing the price of each NFT at a constant rate. Our pricing model provided a built-in incentive to our team that we hadn't considered at first — but we like how it worked out!

Series 1 Start and End Dates

Series 1 Projected Start Date: 2021-12-04 at 07:43 UTC

Series 1 Actual Start Date: 2021-12-04 at 08:25 UTC

Series 1 Final Sale: PasswordChaosS1N31 was minted on 2021-12-09 at 02:07 UTC

Series 1 Population

The number of NFTs minted in each Series is called its "population"

- Projected # of NFTs Minted: 30
- Actual # of NFTs Minted: 32
- Unique NFTs Minted: 29

The number of NFTs minted in Series 2 is a function of the results of Series 1. Remember, we assume a "carrying capacity" or "maximum population" of 1000 NFTs. As a fraction, 30 NFTs is equal to 3% (or 0.03) of the max population, and that defines x_1

The population of Series 2 is calculated by using the formula:

$$x_2 = r_1 * x_1 * (1 - x_1)$$

We also need to calculate r_1 by looking at how long it took for Series 1 to sell out.

Calculating r_1

Every Series sale of Password Chaos will last for a maximum of one moon period (the amount of time it takes for the moon to orbit the earth) which is equal to 27 days, 7 hours, and 43 minutes. We can also express this amount of time as 3.903 weeks.

It took 4 days, 18 hours, 24 minutes (and 2 seconds) for Series 1 to sell out, which is equivalent to approximately 0.681 weeks. This means that there were 3.222 weeks remaining in the Series 1 sale when the last NFT was sold.

Therefore we have:

$$r_1 = 3.903 - 0.681 = 3.222$$

Calculating x_2 and Series 2 Population Size

To determine how many NFTs will be minted in Series 2, we now use the formula:

$$x_2 = r_1 * x_1 * (1 - x_1)$$

$$x_2 = 3.222 * 0.03 * (1 - 0.03) = 0.0937$$

And finally use the value of x_2 to see that there will be **94 NFTs in Series 2**.

$$0.0937 * 1000 = 93.7 \approx 94$$

Series 2: Pricing Mechanics will stay the same

We also feel like we didn't really see this equation in action, so we're keeping the pricing function the same in Series 2.

Series 2 Start Date

Password Chaos Series 2 launched at the full moon, on 19 December 2021 at 04:35 UTC. The Series 2 sale will end when 94 NFTs are sold out, or after one moon period on 15 January 2022 at 12:19 UTC.

Emergent Rarity, Series 1 to Series 2:

One of the things we're most excited about is seeing what sort of relative rarity emerges in each Series of Password Chaos. For both Series 1 and Series 2, rarity is determined by the style model applied to each content image in the pool.

For Series 1, we projected to sell 30 NFTs, so we built an Image Pool of 90 images. Every time someone purchased an NFT, they were presented with 4 choices from that Image Pool.

	Style (in tx metadata, see Style field)							Total	
	terrain	ocg	lava	takashi	lava_force field	nova	mik		
Series 1 Image Pool	18	18	18	18	18			90	
Series 1 Actual Population	5	12	2	7	4	2		32	
% of Target Population, Series 1 (30)	17%	40%	7%	23%	13%	6%	0%	106%	
% of Series 2 Image Pool (See notes below)	Use % of Target Population, Series 1 on the 157 images that are not allocated to "mik"							0.17	
Series 2 Image Pool	26.17	62.80	10.47	36.63	20.93		31.00	188	
	26	63	10	37	21		31	188	
Series 2 Actual Population	?	?	?	?	?		?	94	

Depending on whether we're counting the total number of NFTs minted (32) or the number of unique mints (29), our math would work out a little different in each case. We decided to stick to the intended population (30) in our calculations for setting up Series 2.

You can see that the "rarest" NFTs in Series are those with the "lava" or "nova" styles applied. As we noted above, it was our error that "nova" was included in the drop: so we're going to let those stay rare for now. It also means that if we remove the "nova" NFTs from our calculations, we can look at relative frequency within the other 30. The results are what you see in **% of Target Population Series 1** in the table above.

For Series 2, we are introducing one new model: "mik", and because there will be six models used in Series 2, we're filling 1/6 of the Image Pool with mik-styled images. To determine how the rest of the Image Pool is composed, we took the remaining 5/6 of the Image Pool size, which is 157 images, and then we took the **% of Target Population, Series 1** of that number. Looks like the odds of seeing a "lava" image in Series 2 are going to be pretty low!