Colored Jester: a secure way to transform community engagement into token value

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Introduction

The cryptocurrency market thrives on community dynamics, impacting token values both positively and negatively. A strong community can significantly boost a token's value. Conversely, a token's increasing value might lead to panic selling during market downturns. Additionally, a lack of community engagement can cause a token's value to plummet if interest wanes and members move on to newer ventures. Consequently, investing in community-driven tokens carries substantial risk, particularly for latecomers.

Colored Jester introduces a solution to remove these risks by *adding* community engagement directly to the token value. The concept revolves around an algorithmically supported token where every transaction, whether a purchase or sale, contributes to an increase in the token's value. Investors are thus assured they can exit their investment at any time without facing losses, aside from transaction fees.

This approach guarantees that, at the very least, the token's value remains stable in scenarios of zero community activity. In more vibrant settings, the token's value is designed to consistently rise, since every transaction brings the token value up, offering a more secure investment option in the volatile world of cryptocurrency.

1 The Problem

The predominant risks in cryptocurrency investment stem from a critical underlying problem:

Community engagement elevates the **volatility** of a token, rather than its intrinsic value.

This issue arises from the lack of foundational value, making token prices highly susceptible to shifts in buying and selling pressures. This is especially evident in community-driven or meme tokens, which exhibit significant volatility. Similarly, other protocol tokens, lacking tangible real-world asset backing,

exhibit a pronounced speculative aspect, contributing more to volatility than to actual value.

Consider the example of the SHIB token, a community-driven token that saw considerable success during the 2021 bull market.

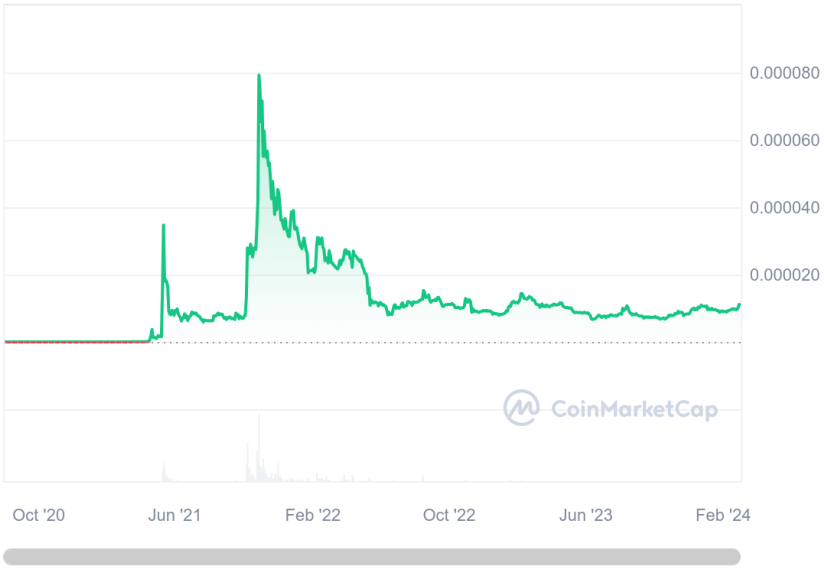

Figure 1: SHIB historical chart

In October 2021, SHIB's value surged tenfold due to intense community engagement. An investor buying in September and selling in October would have realized significant gains. However, the subsequent crypto winter and dwindling interest in the token resulted in a 90

A similar case is observed with PEPE, another well-known meme coin, which recently experienced a volatile period before tripling in value in a few days. Again, optimal timing in transactions could result in substantial profits, but a mistimed investment would likely incur losses due to the token's inherent volatility.

These instances, among others in the market, demonstrate that community engagement does not ensure a stable or increasing token value. Instead, it predominantly leads to heightened volatility, as today's active community can quickly become tomorrow's selling pressure.

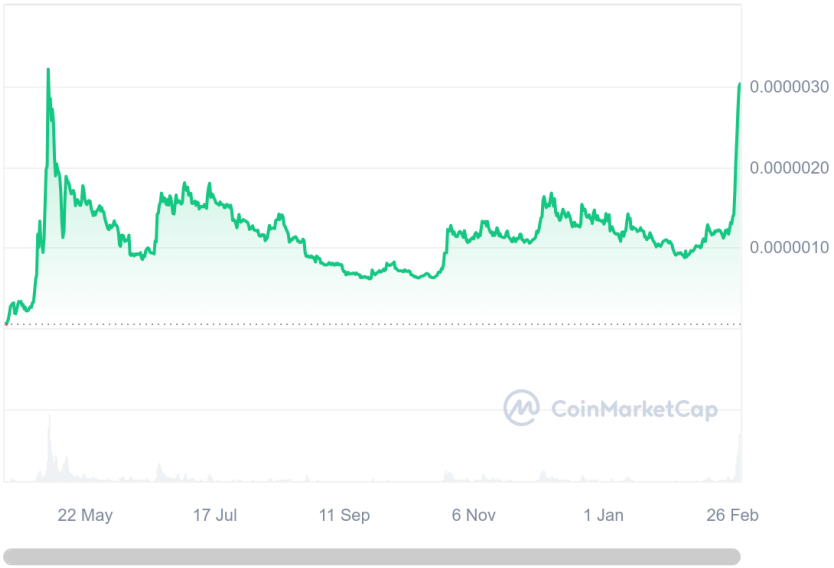

Figure 2: PEPE historical chart

2 The Solution

The solution proposed by Colored Jester is to **create a token whose value is composed by the sum of all community transactions**. In this way, a "pump" of the market will correspondingly lead to a "pump" of the token value, but when the community will disengage, the token value will just remain stable.

This is achieved by the well-known concept of **shares**, which has been brought to the the public attention by OpenZeppelin's ERC4626 standard.

2.1 Overview of the classical shares formula

We recall here the formula used to calculate the shares of a token pool an investor can purchase, as a function of his or her deposit and of the pool's total assets. In the entire whitepaper, we take as granted that there is an **underlying** token (typically a stablecoin like USDT) with which the assets are calculated. Every time we talk about *assets* we mean that they are accounted in this underlying token.

Shares Formula Theorem. *Let T be the total assets contained in a tokenized pool, and S be the total supply of the pool's token (that is, the total circulating shares).*

Let us define the **shares price** *of the pool to be*

$$P_{shares} = T/S \tag{1}$$

Then, by minting to a purchaser who pays D assets, a number of shares $N = D/P_{shares}$, we have that the shares price does not change.

Similarly, by burning $N = D/P_{shares}$ shares from a holder and transferring him or her D assets, the shares price does not change.

To prove this, notice that the pool's total assets increase by D, and the total supply of shares increases by N. Therefore, by calling P the old shares price, the new shares price will be

$$P_{\text{new}} = \frac{T+D}{S+N} = \frac{T+D}{S+D/P} =$$

$$= \frac{T+D}{S+S\cdot D/T} = \frac{T+D}{\frac{S}{T}(T+D)} = \frac{T}{S} = P$$

The proof for the burning case is similar.

This means that investors can purchase and redeem shares *at any time and without any risk*, without changing the value of the pool, or, seen from the other side, the value of the token representing the pool is independent on the actions of the other investors.

2.2 The Colored Jester token

The Colored Jester token adopts a formula which is directly taken from the shares formula, but it adds a *spread* both to the purchase and to the redeem. Calling $\sigma_p > 0$ and $\sigma_r > 0$ the purchase and redeem fees, the formulas become:

$$P_{\text{purchase}} = \frac{T}{S}\cdot(1+\sigma_p) = P_{\text{shares}}\cdot(1+\sigma_p) \tag{2}$$

$$P_{\text{redeem}} = \frac{T}{S}\cdot(1-\sigma_r) = P_{\text{shares}}\cdot(1-\sigma_r) \tag{3}$$

In this way, the Theorem of the shares formula is modified to the following.

Colored Jester Theorem. *Let T be the total assets contained in the Colored Jester contract, and S be the total supply of the Colored Jester token.*

To every purchaser paying D assets, the contract mints to him or her

$$N = \frac{D}{P_{purchase}} = D\cdot\frac{S}{T\cdot(1+\sigma_p)}$$

tokens.

Conversely, to every holder redeeming N tokens, the contract transfers to him or her

$$D = N\cdot P_{redeem} = N\cdot\frac{T}{S}\cdot(1-\sigma_r)$$

Then, at every purchase or redeem, the shares price increases.

The proof is similar to the one of the shares formula, and it is intuitively clear by the fact that each purchase mints a number of tokens which is less than the fair amount given by the shares price, and each redeem transfers a number of assets which is less than the fair amount given by the shares price.

For example, in the case of a purchase, we have

$$P_{\text{new}} = \frac{T+D}{S+N} = \frac{T+D}{S+D\cdot\frac{S}{T\cdot(1+\sigma_p)}} = \frac{T+D}{\frac{S}{T}(T+\frac{D}{1+\sigma_p})} =$$

$$= \frac{T}{S}\cdot\frac{T+\frac{D}{1+\sigma_p}+D\frac{\sigma_p}{1+\sigma_p}}{T+\frac{D}{1+\sigma_p}} = \frac{T}{S}\cdot\left(1+\frac{D\sigma_p}{(1+\sigma_p)T+D}\right) > \frac{T}{S} = P_{\text{shares}}$$

and for the redemption we have a similar calculation.

2.3 TLDR

The above formulas and theorems can be summarized in the following way:

- The Colored Jester shares price P_{shares} can never go down: any action of the investors (both purchases and sales) will increase it.
- Anyone can always buy Colored Jester at a price equal to the current shares price plus a purchase spread.
- Anyone can always redeem Colored Jester at a price equal to the current shares price minus a redeem spread.
- There is no market risk nor default risk, since there are always, mathematically, enough assets to cover the value of the tokens.

This means that the Colored Jester token effectively solves the main problem discussed, that is:

Both community engagement and community disengagement increase the **value** of Color Jester **permanently**.

Since community size only has an effect on the speed of the increase of the value, and not on the value itself, we can conclude that the Colored Jester token is a secure way to transform community engagement into token value, rather than simply increase its volatility like in the case of other tokens.

To make an example, if two Colored Jester tokens both start with a shares price of 1$, and one of them has a community that is twice as big as the other, we can expect that, after a certain time, the first token will have a price of 3$, while the second token will have a price of 2$, but in both cases the value of the token will have increased.

In the worst scenario of an absent community, the token will just remain close to 1$, and the investors will be able to redeem their tokens at any time with only a small loss due to the spread (current spread of the Green Jester is 2% at purchase and 1% at redemption, so the maximum loss is just 3%).

2.4 What about external markets?

Being it a normal ERC20 token, Colored Jester can be freely exchanged. In particular, it is perfectly possible that a pool on an external DeX will be created, either with the same underlying token or with a different one.

However, due to the shares formula and subsequent discussion, the market defined by the Colored Jester contract is *infinitely deep on the single transaction*, meaning that one can purchase or redeem virtually any amount of tokens (the only limitation being the entire circulating supply) at the same price, regardless the amount of tokens.

2.5 Price outside contract bounds leads to arbitrage

This means the following:

In any external market, and considering the price with respect to the contract's underlying token, any price higher than the purchase price or lower than the redeem price leads to an arbitrage.

For example, in the context of an USDT underlying, if the market price is 1.5 USDT, the contract's purchase price is 1.2 USDT, and the external market can bear a sale of 1000 Colored Jester before the price drops to 1.2, then anybody can purchase 1000 Colored Jesters *from the contract* at the purchase price (this is always possible) paying exactly 1200 USDT. He or she will then sell these tokens *in the external market* getting (depending on the bonding curve) an average price between 1.2 and 1.5, say it is 1.3 USDT: the proceed for this operation is thus 1300 USDT which amounts to a sure gain of 100 USDT.

The same process can be made on the other side, if the market price is lower than the redeem price. Indeed, assume that the market price is 0.9 USDT and the redeem price is 1.1 USDT; assume furthermore that the market can bear the purchase of 1000 Colored Jester before the price surges to 1.1 USDT. One would thus purchase 1000 Colored Jesters *from the external market* paying it at an average price between 0.9 and 1.1, say 1.0 USDT. Then he or she can redeem these tokens *in the contract* at the redeem price (this is still always possible) and get exactly 1100 USDT, thus having a sure gain of 100 USDT.

2.6 Cross-token pools increase the price increase speed

The above argument is true for prices denominated in the underlying token, which is USDT in the above example. Assume the external market pool is instead denominated with an uncorrelated token, such as WETH. At equilibrium, if the $WETH$ price is 3000 USDT and the Colored Jester shares price is, say, 3 USDT, then the price in the pool must be around 0.001 WETH (plus or minus a spread less than the contract's one).

Assume now no transaction is executed on the contract or on the pool, but that the $WETH$ price drops to, say, 2500 USDT. Since the pool price is still 0.001 WETH, one can now spend 2500 USDT to get 1 WETH and then purchase

1000 Colored Jester from the pool (we ignore price impact for simplicity). These can then be redeemed in the contract to get 3000 USDT, thus effectively getting a sure gain of 500 USDT.

Therefore, just the fact that an uncorrelated token moves drives the Colored Jester token price up, since we recall that *any* movement in the contract increases the token share price.

3 The fee structure

Colored Jester adopts a fee structure aimed to promote transactions, by reducing the spread with time if no transactions have occurred, and raising it the moment a new transaction is made.

A spread floor is in place to assure that, in any case, a minimum raise of the shares price is obtained at every transaction, even a long time after the previous one.

Finally, a treasury fee can be applied to the Colored Jester amount burned or minted. Since the treasury can mint and redeem at the share price, the treasury's capital can then be used to take advantage of the external markets like DeXes, to raise the price and reward community engagement.

3.1 A Dutch auction for the spread

As we saw in the previous section, people can buy the Colored Jester token at a spread σ_p, and redeem it at a spread of σ_r, with respect to the fair share price.

The actual spreads experienced by a user are calculated via a Dutch Auction which lasts a period T called **zero time**: letting t be the time passed since the last transaction (either a purchase or a redemption), and dropping the indexes, we have

$$\sigma = \sigma_0 + (\sigma_{\max} - \sigma_0)\frac{\max\{T - t; 0\}}{T} \tag{4}$$

where σ_0 and $\sigma_{\max}$ are respectively the **spread floor** and the **maximum spread**, both decided by the governance.

The governance can change the spread floor, maximum spread, and zero time at any moment, with the constraint of $T > 0$, both spread floor and maximum spread being less than 1, and $\sigma_{\max} \geq \sigma_0$. Both the purchase and the redeem spreads have their own floor and maximum spread, but the zero time is the same for both.

This system allows to encourage people to execute transactions if no purchase or redemption occurred for a long time. At the same time, it gives the protocol an advantage with respect to the external markets: thanks to the arbitrage argument described in the previous section, the Dutch auction will make the range of no-arbitrage prices tighter as time goes, thus opening up arbitrage opportunities (or on the other side, increasing the traded volume on the external market) simply by letting time pass.

3.2 Treasury fees

At each transaction, both buy and sell, a percentage of the minted or burned shares go to the treasury. In order to make the contract calculation sound and to keep ensuring the shares price go up at each transaction, the fees are paid *after* the purchase and *before* the redemption.

Here are the examples for a treasury fee of 0.5%.

- Assume a user purchases 1000 USDT of Colored Jester at a purchase price of 2.0 USDT. Then 500 tokens are minted, and of these, 2.5 go to the treasury. The user therefore gets 497.5 tokens.
- Assume a user redeems 500 Colored Jester at a redeem price of 2.0 USDT. Then, 2.5 tokens go to the treasury, and only 497.5 tokens are actually burned at the redeem price to transfer 995 USDT to the user.

This mechanism assures that the treasury fees do not have an impact on the formulas of the Colored Jester Theorem: a simple transfer is executed, which has no effect on the shares price.

3.3 The role of the treasury

Besides the usual tasks of increasing the community, spending for projects in the benefit of the community, or being a greedy jerk who just pockets the entire treasury money (as discussed above, this has no effect on the Colored Jester price!), the treasury has a price advantage with respect to the other users: it can purchase or redeem any quantity of tokens *exactly at the shares price*.

Of course, due to the Shares Price Theorem, a treasury purchase or redemption does *not* increase the token share price (nor it decreases it). However, potential purchase or redemption of the treasury makes the MEV of arbitraging external markets much higher: indeed

Virtually any price different from the exact share price can be arbitraged by the treasury.

Of course this is not entirely true, since frontrunning and transaction fees make prices *very* close to the shares price difficult to arbitrage, but the range it can move in would be very small.

3.4 Who is the treasury?

The initial treasury address is defined in the token deploy. However, the *owner* of the contract (which can be defined as the governance) can change the treasury address at any time.

For example, a collaboration with a developer or marketer or anyone could be defined as changing the treasury address to an agreed one, for a given amount of time. For how the contract is structured, the treasury movements can cause no harm to the investors, nor modifying their shares price.

We can summarize this as follows:

Anyone can be the treasury.

4 Future directions

The Colored Jester is a useful primitive which has great opportunities to be applied on new or existing communities. It gives a secure asset whose value steadly increases following community engagement or market movements.

Further developments of this token can be both on the technical side and on the community side.

4.1 Technical projects

4.1.1 Bonding curves

A possibility to provide to users is to give a non-flat bonding curve at the single purchase. The possibilities are infinite (and even making the curve configurable is possible), however one interesting curve is the so-called *scaling curve*, i.e. the curve for which purchasing twice 1 token, say, has the same price as purchasing 2 tokens at once, assuming fixed spread.

To compute such curve on the purchase side, we write the total supply S with respect of a change D of the total assets T:

$$S(T+D) = S(T) + D \cdot \frac{S(T)}{T \cdot (1+\sigma_p)}$$

Taking infinitesimals, we thus have

$$\frac{\mathrm{d}S}{S} = \frac{1}{(1+\sigma_p)} \frac{\mathrm{d}T}{T}$$

meaning (assuming everything being positive)

$$\mathrm{d}\log S = \frac{1}{(1+\sigma_p)} \mathrm{d}\log T$$

whose solution is (assuming S_0 supply at T_0 assets)

$$S = S_0 \left(\frac{T}{T_0}\right)^{1/(1+\sigma_p)}$$

which can be seen as the bonding curve

$$S T^{-1/(1+\sigma_p)} = k$$

The equation on the sell side is instead

$$S(T-D) = S(T) - D \cdot \frac{S(T)}{T \cdot (1-\sigma_r)}$$

thus giving (same passages as above)

$$S = S_0 \left(\frac{T}{T_0} \right)^{1/(1-\sigma_r)}$$

which can be seen as the bonding curve

$$ST^{-1/(1-\sigma_r)} = k.$$

Notice that since $1/(1+\sigma_p) < 1$, the price T/S is an increasing function of T for the buy bonding curve (that is, purchases increase the price). Similarly, since $1/(1-\sigma_r) > 1$, the price T/S is a decreasing function of T for the sell bonding curve (that is, redemptions increase the price, since they decrease the total assets T). So, for this bonding curve we can confirm the same mechanism as the vanilla Colored Jester token: both purchases and redemptions increase the price.

4.1.2 The Master token

Since the Treasury is customizable, we can think of making the treasury itself a Smart Contract, with a **Master token** which allows people, when burning and staking it, to arbitrage or taking parts of the treasury fees.

Since this contract can pool various Colored Jester instances at once, the value of the Master token is very interesting.

4.1.3 Arbitraging bots

Thanks to the various arbitraging opportunities, and thanks to the fact that each arbitrage drives the Colored Jester price up, deploying pools at the fair price on an external DeX can be a profitable business, especially pairing it with a very volatile token.

In this case, creating highly performant arbitrage bots is key: the treasury will extract most of the MEV thanks to having zero spread (although this reduces the price surge: part of the proceeds should be redistributed to the contract) while the market will keep the external price between the purchase / redeem range.

4.2 Backing existing tokens

Simply adding an **custom token** instead of a native ERC20 contract as shares token, allows to apply the same mechanism as Colored Jester to any ERC20 token. Say, for example, that there is a circulating supply of 1000000 of a given token TKN. Then, one can initialize a Colored Jester contract with TKN as custom token, and back its price with a given initial amount.

For example, inserting 100000 TKN and 9000 USDT in the contract will back the redeem price of TKN to 0.01 USDT (9000 USDT as total assets, divided by 900000 TKN of circulating supply).

The only difference is that, minting and burning the external token being typically impossible, the total supply in the calculation must be replaced with the circulating supply, and minting/burning by transferring the custom tokens outside/inside the contract.

After these details are paved out, the mechanism is the same as before: purchases and redemptions always increase the **backed price** of the token, and redemptions are always possible. Purchases are not always possible in this case, unless the bonding curve on the purchase side is slanted enough to give an infinite price for the purchase of the entire TKN amount.

Depending on the initial price, arbitraging in this setting is of course less likely, the range of possible prices being much higher, in particular for tokens which already have a very strong active market.

On the contrary, this system could be very interesting for protocols at their early stages, when the market is not yet strong, and their price is very low (so the cost of backing it is much lower).

4.3 RWAs and NFTs

All the discussion above can be repeated for any NFT or RWA: the interesting part is that we can do this *both ways*: it is of course possible (and widespread) to back an NFT with a quantity of stablecoins, but this method also allows to *back a token by an NFT, or a RWAs*, or actually any possible combination of assets.

Paving out the details, especially for RWAs, is a challenging but fascinating project which would improve the echosystem reputation even outside the crypto world.

5 Conclusion

We have seen how Colored Jester brings actual value to community engagement and market activity, by **summing** all the values obtained at every single transaction to its share price, which therefore always goes up. This effectively solves the problem mentioned at the beginning of this whitepaper: communities adopting this token will be sure that their engagement increase the token's value, not merely its volatility.

Being the contract extremely simple, it is very safe, its gas price very low, and integrating it to existing projects is an easy task.

Thanks to its flexibility, an enormous amount of future developments are possible: we can safely state that Colored Jester starts a new era in the crypto space, putting value and respect for the investors' money and community engagement first.