The New Age of Funding Public Goods

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In traditional voting schemes such as one person one vote or one dollar one vote, the setup often allows wealthy actors to unfairly influence the outcome or prevent voters from showing the weight of their preferences (see Arrow's impossibility theorem) or even both (see US elections).

Quadratic voting addresses the non-linear relationship between voters and the weight of their preferences. Voters are incentivized to cast votes in a manner that reflects their preferences, but the more they vote for a particular item the more the marginal cost of that vote.

Quadratic funding follows the same principles as quadratic voting, but the use case is funding public goods rather than voting on public topics. The increasing marginal cost of each "vote" is reflected in the decreasing returns on higher donations. This allows voters to express preferences but discounting the influence of those wealthy actors.

Let's take a look at an example:

$10,000 Matching pool			
	A	B	C
Funding raised	$1000	$1000	$1000
# of contributors	2	5	20
Matched amount	$740.74	$1,851.85	$7,407.41
% of initial amount	74%	185%	740%

In the above table, projects A, B, and C are competing for $10,000 of funding. Donors have contributed a total of $1000 to each, with 2 unique donors to project A, 5 unique donors to project b, and 20 unique donors to project C.

Matching funds are allocated according to the total funding raised and the proportion of unique contributors to each project, combining the democratic principles of one person one vote with the preference revealing of one dollar one vote.

A more in-depth article by Ethereum co-founder Vitalik Buterin goes deeper into the economics and math behind quadratic funding and voter preferences.

The mechanism works best in x scenarios, such as budget allocation for a public good, deciding how to develop a public space, and z. Several organizations have trialed quadratic funding, including the Taiwanese presidential hackathon, [some competition at]ETHDenver, Gitcoin grants, and clr.fund rounds. Quadratic voting has even been tested by the Colorado State Legislature.

Vulnerabilities

Because the quadratic mechanism favors more contributors over larger contributions, it is particularly vulnerable to attacks that inflate the number of contributors supporting a project. Two such attacks are:

- The Sybil Attack: an attacker creating or gaining control over multiple identities, casting votes from each in order to gain more vote weight.
- Collusion: Coordination among actors to influence the number of votes/funding they would receive if all parties were to act of their own accord.

Additional issues include its novelty; most voters are unfamiliar with quadratic voting and therefore may be disincentivized from voting or misrepresent their preferences when they do vote. A more in-depth article on the vulnerabilities of QF and proposed solutions can be found here.

Voting secured by Technology

The advent of blockchain sparked a revolution in reconsidering the roles and capabilities of currency, governance, and ownership. Empowered by blockchain, smart contracts enable a “trustless” shared execution environment in which a program runs when predetermined conditions are met.

These trust and security capabilities work well to address the vulnerabilities of quadratic voting. Clr.fund is a decentralized protocol with a community working to make this happen.

Clr.fund

Using smart contracts, clr.fund is a tool that facilitates quadratic funding for public goods on the Ethereum Network. The project is open source and developed by community members, with 6 funding rounds to date allocating a grand total of $27,754.88 from over 930 donors.

Each funding round, individuals can donate to various public goods projects and see their donations matched using a quadratic matching mechanism. The protocol currently addresses the aforementioned vulnerabilities in quadratic voting by incorporating a variety of other projects:

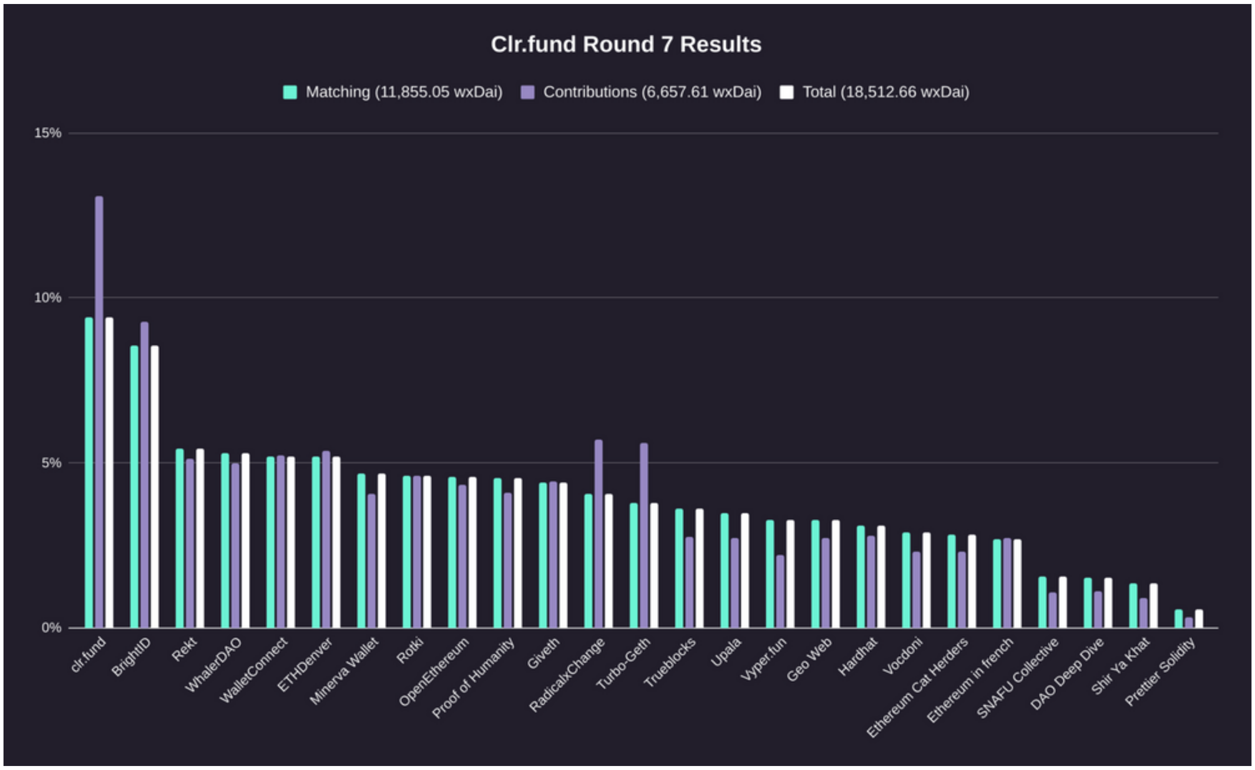
1. Sybil attacks: To prevent voters from using multiple identities, contributors must verify their uniqueness using BrightID in order for their contributions to count towards matching. BrightID protects anonymity but ensures unique identity.
2. Collusion: clr.fund uses zero-knowledge proofs, courtesy of the Minimal Anti-collusion Infrastructure, to keep individual contributions private and limit the effectiveness of collusion and bribery. This means that if you were forced to donate once to a given organization, you could go back and change your destination without anyone knowing.
3. Corruption: the clr.fund protocol currently necessitates an "owner" who serves to set up the instance. This role is set to transition into a DAO to remove any concern for trust.
    a. Currently, matching pools have been made up of funds contributed by Gitcoin, the clr.fund community, and broader members of the ETH community.

    b. In the future, instances of this protocol could find themselves with matching pools fueled by Ethereum protocol rewards, public and private donors, and benevolent protocols such as MakerDAO or Burn Signal.
4. Grant recipients are curated by Kleros TCR. This team of judges determines whether potential projects meet the guidelines of being Ethereum public goods projects.

Conclusion

The jury is still out on whether we're ready to convert massive elections liek presidential bouts into blockchain based infrastructure. out on whether converting all voting to blockchain is the best idea, but in some cases, the technology addresses issues in the non-linear relationship between desire and voting ability.

The Clr.fund team is currently focussed on implementation and improvement on the clr.fund protocol and app, along with making it easier for anyone to spin up their own instance of clr.fund.



Above: round 7 results from June, 2021. where 512 contributors allocated $18,512.66

Round 8 is live and you can look into the various projects on the clr.fund website.

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