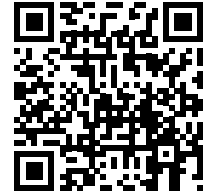


Freedom to transform funding of public goods



Vitalik Buterin

Lecture presented on July 8th, 2021, at the event Radical Futures, of ENAP



Lecture presenter:
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Abstract: The lecture of Vitalik Buterin is about the platform which he created, called Ethereum, and the experiments made in this ecosystem using Quadratic Funding. Hence, he presents the results and some insights over the discoveries made during these processes. Besides that, he also talks about how technology could support changes towards public funding.

Keywords: ethereum platform, blockchain, quadratic funding, public funding



JULIANA: Good evening, everyone! Firstly, I would like to thank the National School of Public Administration (ENAP) and RadicalxChange, for the invitation to moderate such a great panel. It is an honor to be part of this amazing event. Twenty years ago, I had the pleasure of working at ENAP, as my first experience with the government, when I was an intern at the now extinct Department of Economic Protection and Defense.

And now, I am very happy to be here, even virtually, to take part in this important event that promotes groundbreaking thinking and novel actions to promote a more balanced and healthy democracy. In particular, the topic regarding financing of goods, which will be discussed at this panel and is extremely relevant. One of the greatest problems faced by society is the difficulty of encouraging and funding initiatives that have positive effects shared by the community, whose costs are not necessarily equally distributed; the so-called public goods.

In fact, one of the essential roles of the government is to deal with public goods, in order to make sure that they are accounted for proper encouragement. In this sense, the government must prioritize and establish the most pressing issues to invest in, instead of other projects that may be perceived as less urgent, once this creates an issue for democracy in general. So how do we make sure that the most important projects are chosen and are going to benefit most people? Or how to make the funding of public goods more efficient and democratic?

Thus, I think our panelist will bring some insights into the matter, by sharing their experiences. In this sense, we will start with Vitalik Buterin, the creator of Ethereum, a decentralized, open-source, blockchain-based platform, which supports and executes smart contracts. Currently, its cryptocurrency is the second most valuable of the market. Vitalik will share with us his inspiring work on Quadratic Funding and how it can be used as a solution for public goods funding in a democratic manner. So, I am very happy to give the floor to Vitalik. Thank you!



VITALIK: Thank you very much! So, what I wanted to talk about today is some insights on what Quadratic Funding is trying to do, and also on some of the key Quadratic Funding experiences that we had while trying to evolve with the Ethereum ecosystem. Some of the success and some of the learning experiences that we had. And basically, where I think Quadratic Funding could go from here.

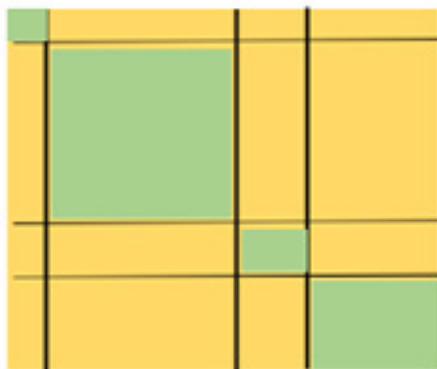
So, I would like to start with some kind of recap of the division, a little bit of the math and the ideology behind the idea of Quadratic Funding. Hence, the idea is basically to try to create something that is kind of half way, which combines the best of both worlds between funding by donations - just people being able to finance projects by donating to them - and regular voting, when people just vote on which project they would like to fund, and whichever project gets the most votes wins.

The problem with these two extremes is that simple voting does not do a great job on reflecting differences in strength of preferences. In other words, simple voting does not do a great job on demonstrating the differences between someone who cares a little bit about a project being made and someone who cares a lot about it. On the other hand, donations, of course, do a very good job on telling this difference.

Because, if you care a little bit about something you donate 5 dollars, but if you care a lot about something you might donate 5,000 dollars. However, the problem with just relying on donations is that it suffers from “the tragedy of the commons¹”, so, it ends up overly favoring concentrated interests. For example, favoring small groups where each individual of the group gets a large benefit from some projects. And overly disfavoring groups where the benefit might be larger but it is much more dispersed. Therefore, there is “the tragedy of the commons”, where no single person feels like their interest is represented.

¹The tragedy of the commons is related to a situation in which the individuals, acting according to their own interests, act against the interests of the community, depleting common goods.

Hence, what Quadratic Funding does is being in the middle of these two. So, basically, the mathematical formula is, you take the square root of each individual contribution, then you sum up the square roots, and you take the square as the output. From this diagram, the green areas are the contributions, you interpret them as squares and the sides are the square roots and the big square which includes the green and yellow squares is the total output. Thus, the difference between the full square and the contributions themselves is what you get as the subsidy pool. See the diagram below:



So, the point of Quadratic Funding is to assume that you have a subsidy pool and the goal is to try to figure out where or how you are supposed to distribute the subsidy pool to public goods. Therefore, the theory behind this is basically... Well, you can look at a couple of things.

First of all, one thing that you can see is that the more individuals contribute to a project, the higher the margin ratio is. For instance, in this diagram, you have 4 green squares and it is full of yellow squares. Then, if you imagine that you have 100 contributors (squares), consequently, you will have 9,900 yellow squares. Because of the way the formula works, the project that gets a larger more diverse set of people, gets a higher margin ratio than the project which gets a smaller and more concentrated group of supporters. And this is intended, the goal of this is to try to be more democratic than just asking for money from donors.

The other interesting effect is also that, the first dollar you contribute to a project, matters more than the second dollar. The second dollar matters more than the third dollar. The third dollar matters more than the fourth dollar, and so on. You can see this from the chart. For example, if you take the square from the top, and you imagine dividing it by four, so each side is done by two, and the yellow area goes down by a factor of two. So, four times more money, only twice as much matching. And this is also to encourage people who only care a little about some projects to still be willing to contribute. Because the smaller your donation, the larger the matching ratio. So, there is a lot of mathematical theory that basically shows how, under some assumptions, this is the optimal way to gather information, which allocates money for public goods. One way to understand what is going on here, is that the contributions themselves are acting like a kind of torque. So, the contributions are both donations but they also help to direct which projects the subsidy pool is going to.

Therefore, these are the ideas. However, one thing that we know about this kind of complex math in economics and ideas is that, often it has a very complicated and unpredictable relationship with reality. So, the thing that we thought about is basically that, we have the Ethereum ecosystem, and it has a lot of need for public goods. Almost everything in the Ethereum ecosystem is public, for instance, open-source softwares, documentations, videos, podcasts, and so on. In other words, anything that people build or create in the Ethereum ecosystem becomes available for everyone. It is not like Apple Square².

²A way of paying for Apple products.

For instance, if you have two Apples and you try to sell them to Alice and Bob. But Alice is willing to pay seven dollars and Bob is willing to pay two dollars, then, you will sell it to Alice. However, with public goods you can not choose which subside of the community benefits and which does not. You just create something; release it and you hope it benefits everyone. And that is how the system works. But the Ethereum ecosystem, I think, is very much like that. The most interesting things in the Ethereum ecosystem are public goods. So, it is actually a great testing ground to see what we can try to use as a public goods funding mechanism and see what happens.

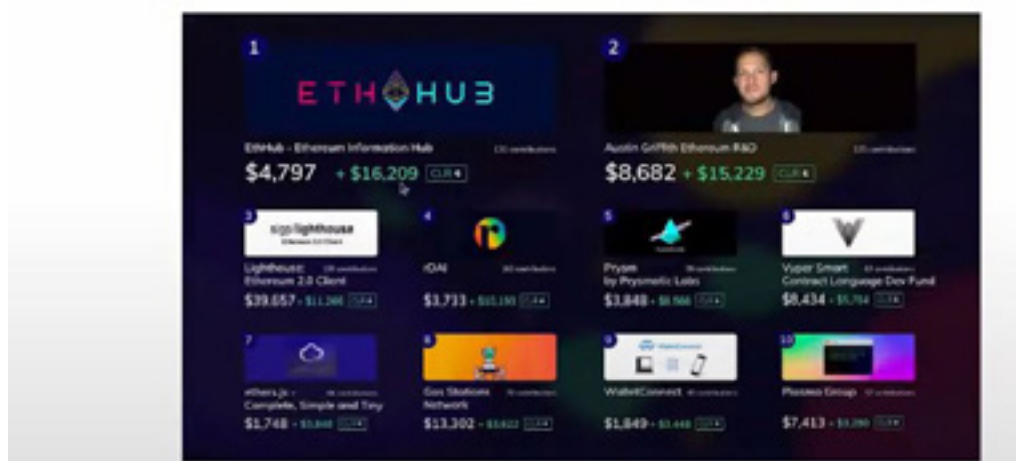
Moreover, before Gitcoin Grants, which was an experiment that started with the Gitcoin team, more than two years ago. Thus, the Ethereum community has many public goods. So, a lot of them are underprovided. Besides that, the Ethereum Foundation is the main fund allocator, with a budget of about 30 million dollars per year. I think it is a little bit more now. In addition to that, other fund allocators include wealthy ICO projects launched on top of Ethereum, there are “Whales” (wealthy ETH holders), and also, companies in the Ethereum ecosystem (for example: Consensys). In other words, a very small number of wealthy actors. In this sense, the idea is, what can we conquer with micro funding sources, in a more diverse and democratic way, so the projects that “Whales” and all of these Ethereum organizations miss, would still have a kind of second chance. If the community recognizes that these projects are valuable, they could still get some funding.

Therefore, basically, what happened was, there was this platform for supporting public goods within the Ethereum blockchain ecosystem, which was an implementation of Quadratic Funding. So, anyone could spin-off³ a project, anyone could donate to any project, and the matching would get allocated according to the Quadratic Funding formula. There have actually been ten rounds of Quadratic Funding (not six as the slide shows), with the subsidy pool funded by quite a lot of donors. Namely, the Ethereum Foundation and Consensys donated a lot at the beginning. But recently, there have been a lot of people who would like to be a matching partner. I can talk a bit about this later. In this sense, the goal was to try out Quadratic Funding in a real life setting and see what happens.

³The creation of an independent company through the sale or distribution of new shares of an existing business or division of a parent company.

Hence, round 1 and 2 were actually quite small and, in my opinion, not much happened. On the other hand, round 3 was probably the first round with significant size. And here we can see the Ethereum page with the top ten projects and how much funding they received. So, the white number is how much they got from donations and the green number is how much was allocated by the matching pool. Then, the two winners were the ETH HUB, a community which runs resources and where you can look up a whole bunch of information about Ethereum. And a lot of people love it, so it got 131 contributions, thus, it ended up getting a lot of matching. The other winner was Austin Griffith, who is an Ethereum developer and makes a bunch of tools that developers love. So, he got a lot of funding for it.

Round 3: the first round of significant size



Therefore, the interesting thing which we started to see was that, among these projects that got funded, there were even projects that a lot of people, the community recognized as valuable. But not really projects that exist in centralized organizations, or were even looked at, like, they were not even under the radar in terms of supporting them. So, I think in this way Quadratic Funding actually ended up working pretty well. Since it ended up bringing up some projects that needed support to the foreground. Moreover, it essentially ended up not just being about allocating funds, but also to signal a way for the community to express what projects they identify as valuable. Accordingly, what did we learn? We learned something that, in my opinion, is boring but good. Namely, although the results were boring, the outcomes were broadly reasonable. For instance, people funded projects that we did not even realize were important. And the process itself made people feel more engaged in the community.

Furthermore, round 4, we ended up splitting it into “tech” and “media”. We tried to separate the two categories and have separate matching pools for them, so they would compete against each other. And, this also ended up surfacing a lot of interesting projects.

Round 4+: split into “tech” and “media”

CLR MATCHING ROUND 4 Tech Grants				CLR MATCHING ROUND 4 Media Grants					
	NUMBER OF CONTRIBUTIONS	TOTAL CONTRIBUTED	CLR MATCHING		NUMBER OF CONTRIBUTIONS	TOTAL CONTRIBUTED	CLR MATCHING		
1	Ternode.com	308	\$3,648	\$27,135	1	Work in Ethereum News	140	\$3,191	\$13,536
2	DAppNode	185	\$2,984	\$8,583	2	Quantropyth	134	\$2,420	\$11,393
3	Solifer	172	\$1,401	\$8,020	3	EthLab	139	\$2,150	\$11,365
4	Multigame	173	\$1,226	\$7,609	4	Borderless (Scholarships)	104	\$2,093	\$5,733
5	DefiTap	177	\$2,369	\$6,807	5	David Hoffman	101	\$1,399	\$5,414
6	Global Sustainability	137	\$7,120	\$4,840	6	Wizards of DApps	86	\$2,088	\$5,258
7	Consensus Simulator	118	\$1,727	\$4,475	7	Cryptoradio	75	\$1,475	\$4,682
8	Pyron	140	\$3,601	\$4,365	8	Ethereum Magicians	69	\$633	\$3,745
9	Univest	124	\$1,715	\$3,439	9	Zero Knowledge Podcast	60	\$503	\$2,998
10	EnigmaKit	102	\$900	\$3,275	10	DeFi by Chris Blue	76	\$2,975	\$2,876

On the “tech” side, it was fairly uncontroversial.

On the “media” side, this one interesting thing happened, the Bitcoin Quadratic Funding decided to fund Antiprosynthesis. Which is basically an Ethereum Twitter influencer. It just makes a lot of tweets which talk about Ethereum and points out things that are important and appreciated about Ethereum. However, this was controversial, for a couple of reasons. For instance, some people have this mentality that “twittering” is not real work, so it does not deserve 20,000 dollars. Because, this amount of money should go to people who really work. And also, it influences the community to separate. If the community wants to give any chance, to decide through their own donations, with this matching mechanism what is valuable, they can actually end up getting a lot of support.

Another interesting thing, which is pretty controversial is that, once you start talking about not just “tech”, but also about, “media”, and also Twitter influencers, then, that is the sort of place where it is easy or there is more of a risk that some people will do things that do not just have positive consequences, but also negative ones. If the Twitter influencer posts something that is in any way polarizing, very culturally worried, very hateful to people, or in some way that people dislike. Then, that is something that very easily can have a very negative impact on the community. What Quadratic Funding does is to not give a way to provide the information which you think could generate a negative impact. Because all you can do is just donate, so, it is just a happy fluffy party. You can just use your money to credibly signal how awesome you think everything is. On the other hand, if you think that something is providing a negative value, there is not really a way for you to put that preference or opinion into the mechanism.

In round 5, we ended up doing an experiment where we allowed negative contributions. So basically, these were contributions which you provided a bit of money and it went to the matching pool, and then we also actually took away from the matching grids the amount of subsidy that would be given to that project. Namely, we could make a 5 dollars negative contribution and it would be taking away 300 dollars from some of the big projects. However, this ended up not working very well. The feedback that we got from the community was basically that although our project won you stole what we did. And they also felt downvoted, which made them feel terrible. Especially in face of the idea that “Bitcoin was supposed to be about the spirit of positivity”. And negative contributions ended up just doing the opposite. However, for me, this was a bit of a conundrum (dilemma), once there is such a thing as negative externalities, and there is such a thing as projects which have positive externalities, but they are overrated by a lot of people. So, it needs to be, I think, if you want an equalistic good mechanism, some way for people to incorporate negative feedback into it. But adding mechanisms for negative feedback that actually work in a social context is really hard.

So, there are other examples of that. One of them is that people have a strong aversion to governments running programs where people can basically rat each other out to the government. So, people have a strong aversion to informing each other, like saying: “Hey, this person is doing something bad”. And this is true even in these cases where the laws the government is trying to enforce, in that particular case, are very reasonable. Hence, there is just something about this idea of informing on someone else that is sort of perceived as people being bad “juju” (cursed, bad person or a snitch). Another example is that very few people are willing to give rates lower than five stars for things like, Uber, Airbnb, and so forth. So, there is this thing, not yet solved. I guess it is a cultural problem or challenge, of how to allow negative feedback without actually leading or turning that into a way of sowing discord. For instance, one piece of feedback that I got is that it would have been less bad if negative contributions were anonymous. So, we have not done this experiment yet, but I found it interesting. This is one of these open question marks, that I guess, I do not know the answer.

The rounds 6 to 9, they sort of have a lot of the same. There are a lot of interesting projects that got funded, even RXT Stock News⁴, which people seem to really like. And also, very interesting. Once it was more than just about Quadratic Funding, it was Quadratic Voting and other interesting projects, like, Bankless, an Ethereum Podcast. Besides that, a lot of community resources, a lot of tech projects, that people found really valuable. There was even one case of a proposal to create for Ethereum an EIP-5050 Dime, which is a proposal to reform how transactions fee economics inside Ethereum work. People liked it. But the community started feeling that Ethereum, towards the development process, was dragging speed on implementing it. So, someone just started a project on EIP-5050 Dime development fund, and it just got a huge amount of funding. I think it got like, half of all the funding in the round 7 and in the round 8. And, that was fascinating! Because it was not just funding, it was also, basically, a way for the community to kind of collectively protest and say: “Hey guys, we really, really think this is valuable and we think you should take this priority more seriously”. So, I thought that this was also, Quadratic Protesting.

⁴Technology which provides history, news and other vital information about stock trading and investments.

Moreover, another thing that we put a lot of focus on was the user experience in rounds 6 to 9, making it easier to contribute to any project. Also, trying to deal with forms of abuse that started to become more significant, as the mechanism got to a larger scale. So, basically, the challenges with all of these voting mechanisms are: One, if you can pretend to be a hundred people, you can have a hundred times more power. In this sense, if in voting it represents a hundred times more power, in Quadratic Voting, it is ten times more power, but that is still a lot. This means that there needs to be some way of identifying who is a unique individual, a real person who is participating in this voting. Which does not work really well in a blockchain based platform like Ethereum. Because blockchain based layers are pretty anonymous. But we did at Gitcoin Grants where we ended up adding a whole bunch of Ethereum based kind of layers on top that tried to provide a unique human verification. Which was interesting.

There were also other forms of abuse, like people trying to bribe others to make contributions. For instance, “I give you 5 dollars for you to donate to me 1 dollar”. So, because of Quadratic Funding, I would also get explained over a match. It means that, the more contributors a project gets, the more matching funds it will get from the organizations which believe in it. So, this kind of abuse, so far, has been handled manually, like, projects that do that, will be exposed and get kicked off the platform. But I think, eventually, some more cryptographic approach, kind of similar to how secret ballots work in elections, is going to be required. So, there are some ideas around that.

I guess the general conclusions, about all these experiences of Ethereum, generally speaking of Quadratic Funding, worked really well. However, it indeed takes time to get up to speed. In this sense, round 1 did not work very well. Because it takes time for the community to actually get up to speed and be able to understand the fine gears of the mechanism. Then, to be able to participate well in it. Besides that, as the stakes get bigger, the potential for abuse also increases. So, it is not just Quadratic Funding, the mechanism theory also proved valuable as a form of signaling.

I guess the next question is, “Where should Quadratic Funding go from here?”. And I think there are two answers for it, well, few answers. One is to continue working with the existing experiments, to try to see what is wrong with the results and if there are ways of improving the quality of the results. It involves improving the interface, also providing more means for people to talk about the projects they find valuable, adding brainstorming systems. It might also mean just increasing the scale over time, so that we can deal with the attacks on a larger scale. And also, applying Quadratic Funding to contexts outside the Ethereum space. So, Deacon has already started doing this. He is thinking of the doubt stimulus in Colorado. They did fund OSS (Open-Source Software) which targets open-source projects in general. But there are plenty of other communities. I think there are both internet virtual communities, then also local communities, of a particular city, of a particular region. That would be an interesting, kind of natural next group that could try to use this mechanism. Then, we can keep going from there.



JULIANA: Thank you, Vitalik! We have some questions from the audience. So, I would like to start with Diego Costa, who is asking: “What kind of regulations should the developing countries have in place to enable that kind of financial environment?”



VITALIK: I guess, for Quadratic Funding, my perspective would be, at least in the short-term, this is the sort of thing that would be probably to experiment with local levels, or particular parts of larger scale governments, instead of separating that from everything else. So, if you pick a particular sector, if you just decide the sector will be funding public media, for example. If you want to support local experiments happening, then, I guess, most of the work is going to be done at the local level. Though, a main policy at a higher level will be required, I guess. And first of all, you will have to make sure that you are not doing anything to prevent this kind of experimentation. But I guess, some program of the government that contributes to any of the matching pools that are being done at the local level, or whatever the structure is, as long as it is reasonable. I do not know. I am just kind of thinking immediately here. And then, for things at a higher level, if you take funding media, for example. I think that just requires that there should be someone in that position who is willing to, kind of, be enterprising and just do interesting things. It requires having people in positions that have the opportunity to start things without having to go through a bunch of “red tapes” or have to do things in the way it has been done in the last 15 years.



JULIANA: The next question is from Fabricio Danny. “What happens for example, if I have a thousand dollars and I split it into a thousand donations of one dollar? Wouldn’t that be like cheating on a large-scale?”



VITALIK: I got the question. It is a very important question. I alluded to this, when I was talking earlier. So, basically, the challenge for Quadratic Funding, you do need to have some kind of identity verification, or at least some way to verify that the contributions are coming from different people. So, if one person sends a thousand different contributions, it counts as one single contribution. Because if you do not do that, people can split their funds, and one person can pretend to be a crowd. And this is not just for Quadratic Funding, I think this is true for any formal mechanism that attempts to be more democratic than a market. So, I think the solution would be, to have some way, like, “proof of humanity” projects, or identity verification solutions. In other words, things that create some kind of cryptographic identity design, so it is hard for one person to get many of them. And, this sort of thing is hard to do. With this kind of solution, like Quadratic Funding, there is a huge incentive to try to cheat them. Hence, it is a difficult problem. But some projects have tried and have done reasonably well, so far. And, Gitcoin is already using some of these things. I think the challenge is to have this kind of solution continuously and making sure that they will also work on larger scales.



JULIANA: Next question, from Claudio Shikida. “In the real world, what would you say is the most common rhetorical argument politicians use against QF (Quadratic Funding)? I am trying to think on how to sell QF to politicians.”



VITALIK: I honestly think that Quadratic Funding is still pretty initial, and many people are seriously opposing it. There are people who have doubts about it in their minds. And I think the kinds of doubts that people have so far, for instance, “Are the crowds wise?”. If you spread out the decisions on them, like, how much a project should get funded across a large group of people? Or, even, do the people who donated 1 to 5 dollars actually have much incentive or just pressure of any kind, to be thinking what kind of things are actually valuable? Or, are they just following their immediate feelings? Which might generate some kind of noise to the signals. Therefore, that is one kind of critic that I have. I definitely heard from some people, “How do you shape Quadratic Funding, so it has some kind of goal or position or expertise or more focused on long-term thought?” And, to be fair, that is still an open problem. I think, at this point, we are not at the stage where we can credibly say that Quadratic Funding is going to fix anything. I do not think either big governments or companies or any kind of institution would replace their funding mechanism with Quadratic Funding, overnight. I think we are still at the experimenting stage. Besides that, the small-scale experimentations that we had so far, seem to have good results in practice. Hence, just like any new way of doing things, we need to keep going to find out what the problems are, and adapt to them. Moreover, maybe we will come up with something better than Quadratic Funding. Maybe we will discover that it is part of the learning process.



JULIANA: The next question is from Bennito. “Can you please make a comparison between the Ethereum funding ecosystem and the Polkadot voting system? How can both ecosystems benefit from the voting evolution?”



VITALIK: I am not very familiar with how the Polkadot voting system works. So, the thing that I can say, in terms of what I do know, is that the Polkadot community and its governance philosophy is much more willing to have activist governance, at layer one, than the Ethereum community. And Polkadot has a base layer on chain governance. And so, in Ethereum basically, there is not any “IFS” being printed to fund public goods, with the exception of the “IFS” that has been hard coded into the protocol to pay for block rewards, which funds the network security. Because that is the one public good that you can measure purely mathematically. So, when we are talking about Bitcoin Grants, and all these other funding mechanisms, they get funded by either individual organizations or other layers to projects that are on top of it. Or, application layer projects on top of Ethereum. I guess the trade-off is that the pool funding that you have if you just find things from application layer projects is smaller. So that is a great risk of the funding being insufficient. On the other hand, if you have layer one on chain funding there is a higher risk of capture. If you want to know what capture means, take one of the dystopias that had already happened to us. For instance, what happened to EOS (a blockchain which works with smart contracts). They had their own chain governance for funding, based on delegated previous stake. And people just ended up just paying large exchanges, ended up paying each other to pay for each other to get delegated seats. As a result, there was a sort of rich cabal of a couple of dozen people that quickly secured power inside the ecosystem. Therefore, eventually, the protocol had to be changed to prevent that kind of abuse. So, that sort of thing happening is, to me, the risk of any own chain governance. Hence, I continue to think that people who do not take these kinds of issues seriously enough. I guess we will see how that goes.



JULIANA: We just have a few more minutes, so this is the last question. “What kind of books, articles, and movies were fundamental in your intellectual journey? And what would you recommend for people getting started now?”



VITALIK: I have a weird and fun answer, so, recently, I have played the game “Sad Words of Catania”, and the thing that fascinated me was that it was a metaphor. So, you know how, when one talks about politics, people often use chess as a metaphor. And the thing that I realized about it is that chess does not cover the complexity of real public interaction. Because chess is a two-player game, and public interactions are anything greater than a three-player interaction. Hence, there is a fundamental difference between a two-player game and a three-player game. And the thing that became obvious in the game “Sad Words of Catania”, it is very easy to kind of charge ahead, instead of building your settlements and getting your points. But, if it looks that you are winning, everyone starts gaming up against you. Then, you will lose and someone else wins. In chess that does not happen. Once, if you manage to get lucky and eat the other guy’s queen, you basically won. Basically, the lesson from this is that, in a two persons-game, it is just you and the other person. And if the game is competitive, all you do is play strategies to get advantage over them. But still, it is a kind of mathematical track that you should understand. On the other hand, when the number of players goes above two, then, the most powerful strategy is organizing coalitions and discourage coalitions from being organized against you. And that is actually, fundamentally a very different style of playing. You have to think about issues like, if you use certain strategies, what will be your public image. So, the kinds of challenges that you deal with, end up being very much not like chess. I guess the conclusion is that. Thank you!



JULIANA:
Thank you very much, Vitalik!

