



SAGECITY

Technical Whitepaper

## Abstract

Cryptocurrency is a rapidly expanding industry and rightly so: the technology has the potential to reshape and improve every industry in the world. The blockchain is this generation's internet-like innovation and just like the internet hype of the early 2000's there is a large wave of people beginning to use cryptocurrency and over \$150bn has been invested in the ecosystem. While this great news for the industry and crypto economy, it has raised challenges on popular blockchain infrastructure and whether these networks can cope with demand.

Sagecity has a very simple goal: to improve the blockchain and then improve the world. Our platform is an innovative hub that can be utilised by any person or entity of any size to act as the foundation of the project or to streamline and support a process. Our name SageCity is a play on the term Sagacity, a quality one can possess or to be sagacious, in action. The definition is:

“having or showing keen mental discernment and good judgement; wise or shrewd.”

We consider ourselves to be sagacious and want people with similar qualities to use our blockchain and tools. The future brings good fortune to those who are wise and can see and manage the road ahead.

## SageCity Vision

The SageCity platform is the Silicon Valley of the digital currency scene. It's for people with a powerful vision for the future who want to build innovative products and concepts in an active and like-minded community. The SageCity platform provides people with the tools and foundation to run any kind of operation easily, efficiently and at as low a cost as possible by utilising and deploying process specific sidechains. To enhance our platform, we have developed SAGE, which will act as the native cryptocurrency to the SageCity network and allow for seamless transacting amongst the community anywhere in the world.

The Sagecity Platform is built on strong fundamentals and technology to provide a network which can support all users goals and cope with growing demand. Current blockchain solutions either lack accessibility to solutions a user may want or lack the infrastructure to host all the development being carried out on top. We have devised a way by utilising sidechains to provide potentially infinite scalability. By basing our platform off of the most successful and tested solutions to date means that SageCity is a force to be reckoned in the cryptocurrency arena.

Cryptocurrency requires a fresh perspective from anyone looking to get involved and often with this perspective requires new skills and techniques to be learned by a user. The majority of Blockchain platforms still lack that intuitiveness or knowledge base for a user starting off with minimal knowledge for relatively simple tasks let alone token creation and management. We designed SageCity so that a user of any calibre can find their way around Sagecity and use it to fulfill their exact needs.

Making sure Sagecity is visible and easily sourceable as a solution is also of great importance to the project and we will be encouraging and locating people from all around the world to build on SageCity. We've made sure that our platform is adaptable (or can work in conjunction) with other blockchains and tokens, primarily the Ethereum blockchain as they have similar architecture and both use Solidity as a programming language for smart contracts.

In the future, we want to take our digital innovation hub and expand into a physical realm by building spaces which harness blockchain technology. SageCity will be the first decentralised city in the world and we see many opportunities for blockchain technology to appease existing technology such as renewables, IOT devices and modular spaces and harness them in new ways to improve our economy and society for the better of all.

## Platform Overview

- Fair launch
- POW (proof of work)
- Ethash algorithm
- 96.7m total supply
- Block time: 1 minute
- 3% Founders reward per block (Locked for 12 months)

## Economic Model & Impact

Sagecity is a mineable proof-of-work (POW) cryptocurrency with no premine. There is no ICO and the platform is completely fair launch. We believe equal initial opportunity is a sound model in the case of the Sagecity cryptocurrency launch as the earlier the adopter, the larger the reward due to the risk undergone.

A gradual growth in supply will roughly correlate to a gradual growth in users and reduce the chance of a “stifling” of price due to an overpowering ratio of coins to buyers. The liquidity and value of Sagecity coins should also increase with time and adoption. Sagecity coins act as a liquidity layer between tokens on the network and fiat. Due to the network speed and efficiency,

Sagecity can be used as a settlement layer due to its speed and ease of exchange over fiat and to a slightly lesser extent, other cryptocurrencies.

The initial value in Sagecity comes from the network improvements from the concept of ethereum. As the network grows, the true value of these improvements will become clearer as performance will be noticeably better compared to other platforms of similar capacity.

SageCity’s long term value depends on innovation and successful businesses utilising the technology developed. As the usage of tokens increase, SAGE value will begin to stabilize and it will become an essential aspect for transactions and smart contract settlement.

**Block reward**

Up to block	Reward	Total created
525000	25	13125000
1050000	25	13125000
1575000	25	13125000
2100000	25	13125000
2625000	12.5	6562500
3150000	12.5	6562500
3675000	12.5	6562500
4200000	12.5	6562500
4725000	6.25	3281250
5250000	6.25	3281250
5775000	6.25	3281250
6300000	6.25	3281250
6825000	3.125	1640625
7350000	3.125	1640625
7875000	3.125	1640625
	Total Supply	96796875

## Code Origins

The SageCity platform originally began as a fork from the ethereum codebase but has been improved upon since. The primary reason for this decision is the fact that ethereum already provides a number of the features we were initially looking to implement. There are a number of benefits to this decision with the main ones being:

- Solidity is the leading smart contract language, it will allow experienced smart-contract developers to migrate to the platform with minimal disruption
- Exchanges and other cryptocurrency services have the infrastructure already built to accommodate for ethereum and will require minimal alterations to accept Sagecity.
- Users will not have to adapt new habits or activities if they are experienced with the concept of Ethereum and in many cases their experience will be easier to use.

We have another headstart in that we can utilise a wide range of open source ethereum applications and infrastructure. It also allows for existing ethereum projects to transition over or expand to multiple chains without difficulty.

## Security

We take security and the integrity of the Sagecity blockchain very seriously. We have an initial advantage due to being based on the Ethereum codebase as the code has been vigorously used and scrutinised for the last 5 years meaning the chances of high level vulnerabilities and bugs are initially low. However, no code is ever perfect and future risks are always possible. Prior to launch Sagecity underwent an extensive independent security audit carried out with results available for public consumption.

As part of our aide to businesses looking to utilise our platform, overtime we will also be providing purpose-specific smart contract and sidechains templates fit for most business needs which will also undergo audit scrutiny prior to release.

## Features

In version 1 of the Sagecity platform scalability and combating network congestion are the main focuses. We believe it is important to have a platform that can handle close to an unlimited amount of transactions for an unlimited amount of parties. While we acknowledge that these problems may not be a serious problem on the network until the platform reaches maturity, we do want to have the infrastructure in place so that the network isn't blindsighted and bottlenecked.

## Sidechains

Sidechain technology already exists but it is hardly being used to its true potential. Sidechains provide a way to increase a blockchain's performance by deploying extensions rooted to the main blockchain. Transaction records on the sidechains synchronize periodically with the main blockchain and users can perform transactions on the side chain without interfering with the main chain therefore reducing congestion and opening up the possibility of increased efficiency. This allows the users to have (depending on the design) lower transaction fees, faster transaction confirmation and features unavailable on the main chain (such as business-specific modifications to the sidechain or experimental features).

## Plasma

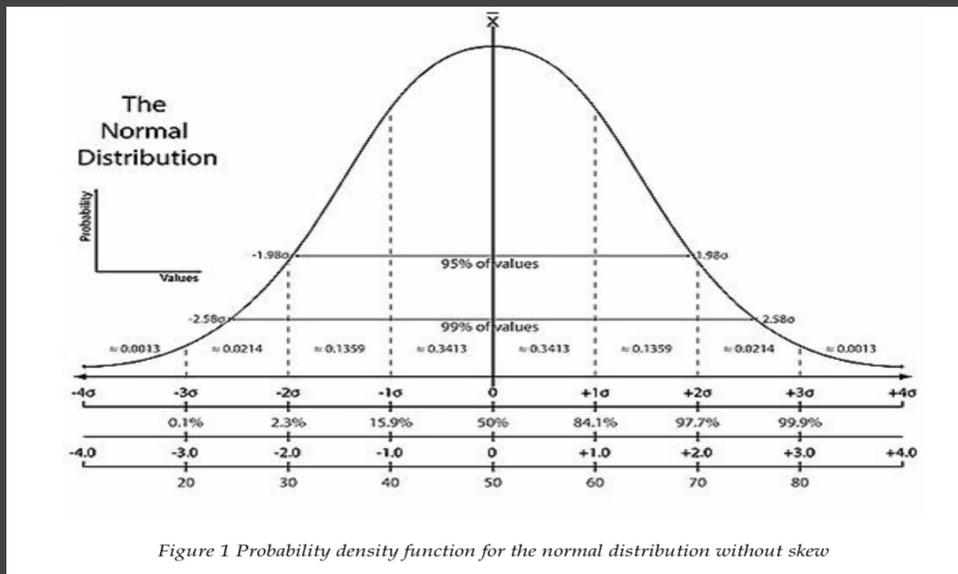
Plasma is an idea on how to increase the scalability of Ethereum proposed by Joseph Poon (creator of Lightning Network) and Vitalik Buterin (creator of Ethereum). In general, Plasma provides an off-chain/side-chain solution to increase Ethereum scalability by rooting the side-chain into the mainchain. This also allows you to have multiple Plasma sidechains rooted to one Plasma sidechain. We have adapted this technology to work alongside the SageCity blockchain.

## Statistical Congestion Clearing (SCC)

Treating blockchain congestions as statistical events which belong to a specific distribution opens up the possibilities for additional congestion control mechanisms. According to the Central Limit Theorem, all statistical events, when in sufficient amounts, tend to belong to the normal distribution. Considering that there will be a potentially large amount of incoming transactions containing different gas prices, we can say that the gas prices in question will belong to the normal distribution. There are three possible variants of the normal distribution:

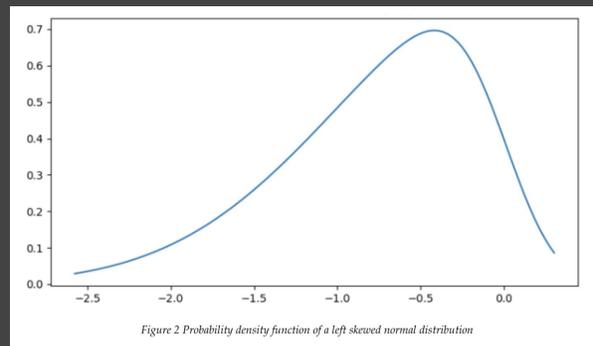
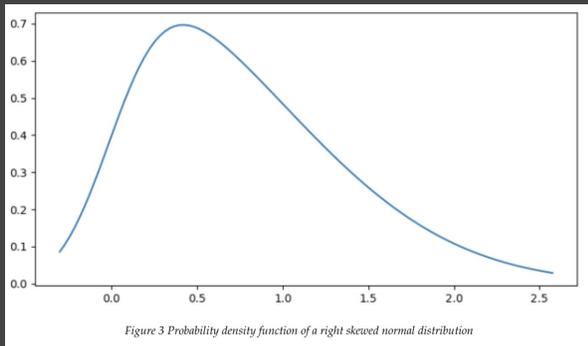
- Without skew
- Left skewed
- Right skewed

Normal distribution without skew has a probability density function which contains the majority of statistical events near its mean. Furthermore, 95% of all statistical events are contained in the range between  $-2\sigma$  and  $2\sigma$ , where  $\sigma$  is the standard deviation of the distribution. The mean and mode values in normal distributions without skew is the same value, where mean is the average value of all events belonging to the probability density function, while mode is the value of the largest statistical event in the distribution



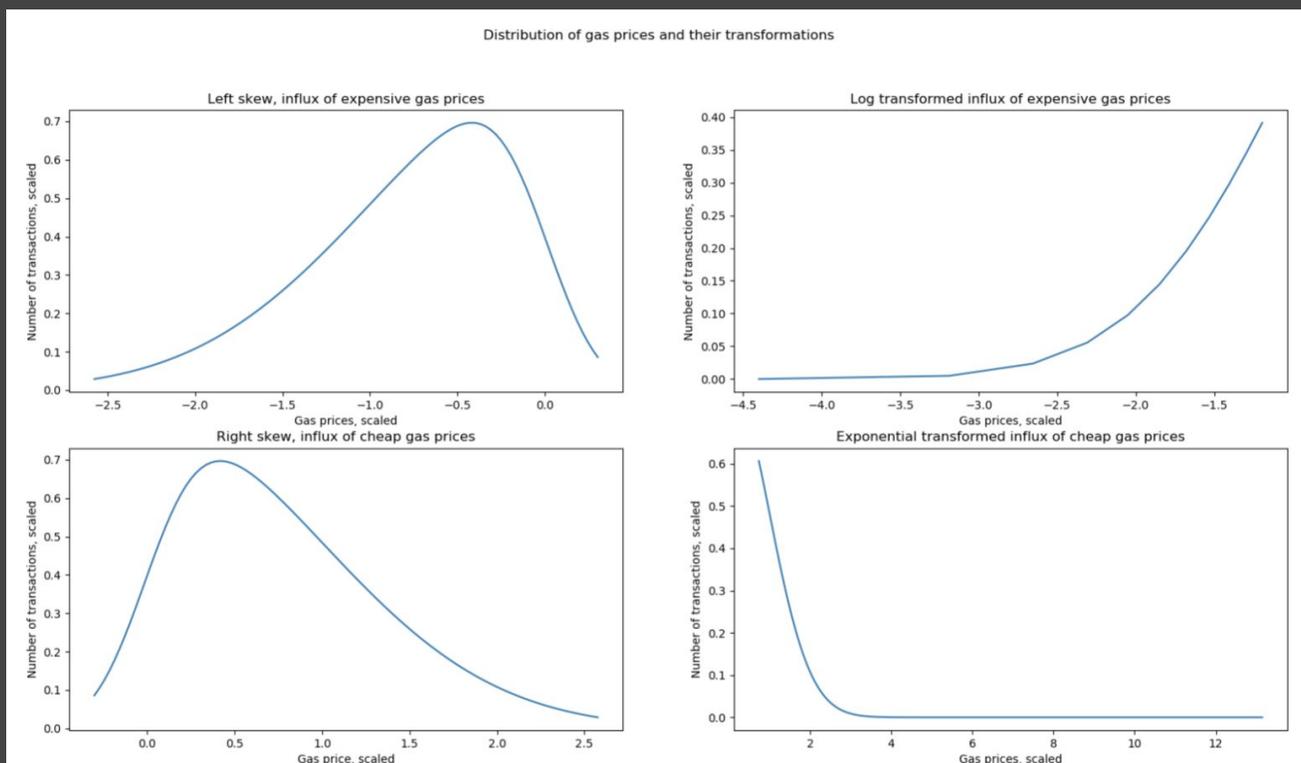
Applied to SageCity, the normal distribution without skew for gas prices is the ideal case and would mean a situation where the network starts processing transactions left of the mode until the total processing capacity. Unfortunately, having a normal distribution without skew can be impossible (unless we hit the Central Limits Theorem, but at that time, there would be more important issues to worry about).

Left skewed normal distribution has a “tail” to the left of the mean in its probability density function. Left skewed normal distributions have their mean lower than their mode, thus accounting for their characteristic shape. Right skewed normal distributions are the opposite of left skewed normal distributions—their mean is larger than their mode and have their characteristic “tail” to the right”.



Most commonly, SageCity will encounter left skewed and right skewed normal distributions with incoming transactions. Left skewed normal distributions represent an influx of very cheap gas prices, while the right skewed distributions represent the influx of very expensive gas prices. Processing them as they arrive (after sorting by amount) is possible, but with a waste of resources due to the fact that there is a very large number of transactions which have identical gas prices, thus creating a bottleneck. Transactions in this bottleneck would have to get processed by their time of arrival (or some other method). On the other hand, applying statistical transformations to the distributions would allow you to keep the original ordering of the transactions (their distribution), but change the gas prices to be more detailed, so you would have a way of processing transactions while minimizing congestion.

Furthermore, in this case, gas prices would've been changed. You can keep these changed gas prices and process based on the results, or you could process the original gas prices while using the transformed results as an ordering mechanism. In case of left skewed distributions, using the Log transformation function would allow you to order them more specifically. Since right skewed distributions are an opposite of left skewed distributions, the transformation function which should be used is the Ex function. Applying these functions to the gas prices would yield the following chart:



By setting a cutoff point (maximum gas price you are willing to take into the account), you are able to segment which transactions you wish to process. In case of left skewed normal distribution, you would take the values from the left, up to the cutoff point. In case of right skewed normal distribution, the process would go from the right to the left –since the most expensive ones are on the left side of the chart after which they gradually drop in volume. Utilizing the resulting data from the transformed functions to the right, you can see how easily you can handle left skewed and right skewed normal distributions. Having the transaction running at the client and talking with all other clients would allow you to have a distributed system which talks with other clients to aggregate and calculate the necessary transformations. This way, the clients would be able to synchronize which transactions to process and at what time. A minimal downside of this approach is that a small amount of processing power would have to be spent in order to calculate the transformations. Utilizing multiple clients which talk to each other would allow you to cache some values and speed up processing, as long as the system is running.

Statistical Congestion Clearing will be the basis of our “Congestion Engine”: A development of a range of tools and processes which aim to help alleviate or quash congestion issues the SageCity network may face.

### **Sidechain Hopping**

Sidechain hopping is a method which would allow the user to accelerate the processing of his transaction by converting the value of its SAGE into one or more sidechains before converting it back to the SAGE coins. This process would utilize Dijkstra’s shortest path algorithm to identify the sidechains where the transaction processing times, when summed, would be lower than to wait for your turn on the main blockchain. Even though this methodology has been devised in order to lower the transaction wait times, it can also be applied for evading congestion by “promoting” certain transactions, thus lowering the queue on the main blockchain. The promotion process could be performed by the Congestion Engine as discussed above.

### **Token Creation Fee**

The ethereum network is already larger than the Bitcoin network in size and has operated for less than half the duration. Ethereum has an enormous directory of tokens created on the network. When the founder of SageCity, Adam Greenberg was consulting with a company about utilising ethereum for business needs he found there were already 12 iterations of the token name they wanted to use. A part of the large directory is the bewildering amount of tokens being created and never actually being useful. The ICO startup frenzy in 2017 has resulted in

thousands of tokens with little chance of real adoption and attracted reports of tokens faking interest by transacting tokens aimlessly amongst themselves.

With Sagecity we believe a simple “creation fee” could reduce the quantity of tokens and increase the quality of them. A token fee acts as a natural deterrent for useless or scam tokens. If you are confident your token will actually work then paying to use Sagecity’s superior platform to support your business makes sense.

It also creates an unexpected benefit for a business looking to utilise a token on Sagecity. Traditionally with any cryptocurrency coin, there is generally a base cost to create a single coin whether it be POW or POS etc. With tokens there is no inherent value. In the creation fee model there is a base cost which will have the potential to stabilise a token economy quicker than typically seen in the past and allow a business to hit the ground running.

### **Founders reward**

Over the course of the mining life span, 3% of each block will be set aside. Over time these funds will be released to community developers as part of grants and competitions for startups and projects to build applications and tools on the Sagecity network. We will be utilising our governance model to distribute the resources allowing the community to choose which causes and projects to support in a fair and accurate manner.

### **ICO Pledge**

In the past, the Ethereum network has been completely halted by ICO’s. On the 20th of June 2017, the ethereum network was effectively unusable when the Status ICO began accepting payments. In the end, a number of people were rejected and the prices in gas to get a payment through were extortionate. It was reported at the time that someone spent more than \$1000 in gas to be “at the top of the queue”

With Sagacity we propose a new way to host an ICO, especially in situations where the ICO is in high demand in which someone wishing to take part “pledges” the funds. The following is the process a pledge ICO would follow:

- A company announces an ICO and gives users a period of time to create a pledge (we recommend at least 30 days)
- Users can send to a pledge address in this period or activate a pledge contract which locks the funds until ICO launch
- Once the ICO opens, the funds are gradually sent to the crowd sale - reducing network strain

- If an ICO raises too much, a percentage is calculated and that amount is deducted from everyone's amount sent, with the excess sent back to them.
- If not sold out, the ICO carries on as normal

While the most obvious use of this concept is with ICO's and crowdfunding. The framework for this activity would also provide the basis for other activities such as donations and subscriptions.

## Governance

We view cryptocurrency network governance as an important factor in the future success of a cryptocurrency. Not only does it make the network more self sufficient but if done correctly allows for a true reflection of all types of users opinions and for decisions to be made accordingly which in turn prevent financial and economic risks. A number of controversies surrounding major currencies such as Bitcoin and ethereum could have been resolved more efficiently with this kind of infrastructure in place with noteworthy examples being the segwit/2mb debate and the DAO hack which is why we have developed our Reputational Meritocracy concept.

Implementing a successful voting protocol is extremely challenging as there are a number of hurdles to overcome such as making the system manipulation resistant and encouraging user turnout. For the DAO Carbon votes on ethereum, the turnout never reached more than 5% which makes the voting system redundant if it doesn't truly reflect the networks real consensus.

To summarise, Our governance model must be successful in:

- Accurately reflecting the state and opinion of the user-base
- Allowing everyone a say based on their merits
- Assessing everyone on fair factors which don't discriminate based on aspects outwith a users control such as location, wealth, associations. Ie. Situationally adverse.
- Can't be gamed or manipulated by a wealthy or resourceful individual or group.

## Process and key term glossary

Pre-merit -> Values -> Believability -> Proposal -> Post-Merit

**Pre-Merit** – static values defined by the users of the network. In the beginning, these are factors such as but not exclusively: transaction volume, coin quantity and duration held.

**Values** – These are the SageCity network values and in this stage users define what is factors are most important from Pre-Merit. This is then fed back into the system for further tweaking as voting goes on.

**Believability** – each user of the system will fit somewhere inside of a normal distribution (due to the Central Limits Theorem). Our goal is to verify if the users fit in the 95% confidence interval so that they can be treated as fair voters. This score is calculated from the ratios defined in Pre-Merit and Values. Values can be determined using Analytical hierarchy process (AHP) / Delphi method during voting (or their derivatives, depending on the complexity of the voting). We want to make the voting as simple as possible, while improving the network in a feedback loop.

**Proposal** – this is the voting part of the whole system. Each vote should be followed by it's Terms and Conditions (similar to financial instruments). The T&Cs define the scope of the vote, impact of it, as well as negatives and risks. This allows everyone to see directly how their vote will affect whole SageCity and possible consequences. The initial step is to decorate the vote with questions about their motives to evaluate their understanding of the matter before proceeding to the vote. These questions are inputs to the AHP / Delphi / Sagecity Merit. With these questions we are able to shift and tilt the original Pre-Merit defined ratios by influencing with Values.

**Post-Merit** – after a proposal has been completed, the scores are calculated and the ratios are modified by a vote, depending on the closeness inside the normal distribution, as well as the qualifications to vote on the topic and are assigned to each user. This calculation evaluates on a range of factors but relies on comparing answers and results to peers, similar to how a node in a cryptocurrency network would operate.

## Initiation

The model initiates by establishing value priority. This is essentially the first stage of an AHP process in which you set the factors and importance in relation to each other. Users vote on a set of values and how important they think they are to the network. These Values are as follows (descriptions can be found in the Sagecity Business model):

### **Self-Sufficiency - Prosperity - Sustainability - Community - Meaning - Sagacity**

These values each have quantifiable qualities attached to them which help establish an initial believability rating for the user. For example, Community could take into account factors such as duration coins have been held in the users address as community members are likely to hold coins for longer periods of time that those who wouldn't consider themselves community

members. To establish these value ratios we assess each user on the assumption that each value is of equal importance.

Value	Percentage of influence
Self-Sufficiency	16.6%
Prosperity	16.6%
Sustainability	16.6%
Community	16.6%
Meaning	16.6%
Sagacity	16.6%

When people establish the values, the values then become more aligned with the overall consensus of the network, a result might end up like this:

Value	Percentage of influence
Self-Sufficiency	14.5%
Prosperity	25%
Sustainability	8%
Community	17%
Meaning	13%
Sagacity	22.5%

In this example, hypothetically the users have decided that prosperity now equates for 25% of the overall pre-merit and now going forward on later stages users will be weighted on this. A user with high sustainability values for example, wouldn't have as much influence as a user who embodies the qualities of prosperity.

Every user who joins the governance model votes on which of these values they deem to be most important and their pre-merit establishes how much they can sway this. Every 6 months an airdrop occurs to give people voting tokens based on their believability and users can re-do their vote on value priority. This is to compensate and adapt with various trends that may occur. For example, when the SAGE coin supply is completely mined, a miners role won't be as influential as it once was and the values need to reflect that so that miners don't dominate the way a vote on a proposal goes. There will also be a cap on how much a factor can sway each period around 2.5% threshold. There may be short term trends or concerns which could heavily

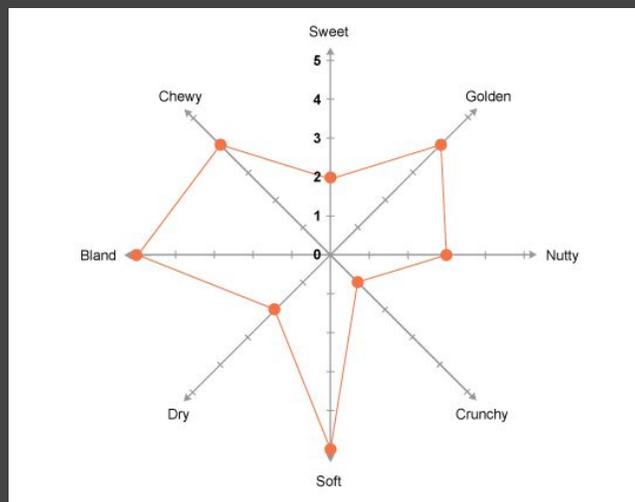
influence the the value ratio so longer term trends will constantly reduce or increase a values influence by 2.5% each reassessment period.

### **Believability = Pre-merit + Post-Merit**

Initially a users believability will be based on what they bring to the network but over time this believability will also take into account how they vote and interact with proposals. Those who don't understand how things work or have self interested intentions will score poorly here.

By gathering the responses from questions at the beginning of a proposal process, we can gather what the users think of the best “archetype” which can provide the vote for this question and if they understand the contents of the proposal. Each user has a value assigned to them, so that they are predetermined to give perfect votes for some topics, while they can also give bad answers to other ones.

Having these multiple parameters we can start doing Principal Component Analysis (PCA) to determine which questions actually influence the ratios the most. Having this, we are able to determine which questions are the most polarising and provide the most insight into users. Each voter will be assigned a star diagram representing their strengths and weaknesses (similar to the picture below).



According to this diagram, A user can see where they fit in the whole SageCity model. This also has the potential to be utilised in other areas of Sagecity (with the users consent.)