Crypto Educational Dashboard

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Abstract

The cryptocurrency space has seen exponential growth and cash inflows in recent years. The rapid growth requires investors to be knowledgeable on multiple metrics about multiple assets at any given time. On top of that, significant announcements are made daily, further requiring investors to stay consistently up to date. We streamline the process for these investors by providing them with overall and asset-specific metrics at their fingertips through a single interface. Our approach aims to enable even the most novice investors to make educated financial crypto positions.

Github Classroom:
https://github.com/DS4200-S22/final-project-crypto

Keywords: Cryptocurrency, education, visualization.

1 Introduction

Cryptocurrency is a field that has been gaining a lot of notoriety over the past few years, with stories of people making millions of dollars in just a few months. However, there are countless scams, security firewalls, and everyone always thinks they know what the best option is. There are various softwares and terms of service that are hard to understand. Additionally, a person can invest in nearly an infinite number of different coins. For all of the above reasons and more, cryptocurrency is not an easy field to enter. Most of the projects listed will not make the investor money, so it is important to enter this field only when you are educated on the topic. However, there is a lack of educational dashboards on this subject. This project will help people who are entering the field to do it in a safe way in which they will operate in the cryptocurrency space with a positive experience. The final visualizations of this project will be different dashboards to help beginners better understand this field and give them the ability to make safe and smart investments.

2 Related Work

2.1 Interactive Visualization for Extracting Bitcoin Exchange Intelligence

This research article provides insight into crypto exchanges, which are the gateway into the crypto world. For novice users entering our educational website, we will need to inform them how these marketplaces operate and best practices. We anticipate using features from "Figure 1" in the article to show the different crypto exchange rates from various crypto exchange marketplaces. We can display a visualization that shows the best marketplace a user should use based on the crypto coin they wish to trade and the country they reside in. [1]

2.2 The Economic and Environmental Impact of Bitcoin

This research article debates the environmental and social impact of trading and mining cryptocurrencies. We want to include this information on our educational website so that our users are educated on the social impact of cryptocurrencies. We also will draw inspiration from "Figure 4", which shows the legality of buying and selling cryptocurrencies by country. This could be an interesting visualization to display when users first join the website to ensure that what they are doing is legal in their country. [2]

2.3 CryptoMarket Tableau Dashboard

This Tableau dashboard displays the world's top 20 current cryptocurrencies. The main visualization is a circular object which shows the total value or the current 24-hour trading volume of the top 20 cryptocurrencies. The differences in magnitude are reflected by the currencies' ability to wrap around the circle, with the largest currency being the outermost ring. Additionally, it provides information on the current unit price, circulating supply, and the 7-day trends of the displayed currencies. This visualization does a strong job of comparing currencies. However, it is visually dense and confusing and isn't a teaching or informative tool. [3]

2.4 A Systematic Review of Online Bitcoin Visualizations

This research article provides a systematic review of visualizations used to describe and inform consumers of cryptocurrencies. The article uses consumers' survey data and their expertise to discuss the strengths and weaknesses of various visualization methods. Additionally, this article includes examples of some of the most used visualizations in cryptocurrencies. We will display most of these visualizations on our educational website to familiarize users with the most common charts and graphs used to describe and analyze the crypto market. [4]

2.5 Visualization of Blockchain Data: A Systematic Review

This research article displays different visualizations of blockchain data to theorize how the crypto market will behave in the future. This article's visualizations are more technical than the above articles. We find them difficult to interpret; however, we will use this work as a reference point for visualizations we may want to avoid as they could be overwhelming for the novice crypto users we intend to target. We may include visualizations similar to these if we build out an entire educational program on our website. Visualizations in this article could be used in some of the higher-level courses where users are more familiar with financial figures. [5]

3 Use Case

To demonstrate the value of a cryptocurrency dashboard, we present a usage scenario in which a potential investor utilizes the tool to educate himself on the relevant metrics and track historical data to make informed financial decisions. For this scenario, let's look at a beginner investor who wants to broaden or start his crypto portfolio.

Without our tool, they would likely look up price data through simple google searches for each asset which is time-consuming and overwhelming as the data is not centralized or user friendly. Alternatively, they could use a platform such as trading view to view candlestick charts and price data. Still, we believe many novice traders do not have the software or experience to utilize these platforms. Furthermore, these platforms are catered to experienced financial investors and do not provide educational information aimed at ordinary retail investors. It may provide the user with the relevant information, but if they do not understand each of the indicators, the platform becomes more confusing than helping.

In the case they are using our tool, they will be presented initially with an overview of the crypto market, with breakdowns of top-performing assets and relevant indicators. While the investor in this scenario has exposure to Bitcoin and Ethereum, also referred to as 'crypto blue chips', they are not sure what other assets have a similar level of backing. They see a breakdown through a pie chart by market capitalization and see which assets trail closely behind the blue chips. The trader can see that Binance Coin is following closely behind, which piques their interest. However, the investor is not sure what market capitalization is or why it is important. To get that information, the user can hover over any of the metrics and indicators, and they will get information about what it is and why it is important. After learning about market capitalization, the investor wants a deeper dive into Binance Coin so they can click on the asset, which brings up asset-specific visualizations. Here, they will see max supply, circulating supply, total supply, rank, trading volume changes, percent changes, and market cap dominance over different time frames. Like with market capitalization, the user can hover over any of these indicators to better understand what each one is. After looking at the metrics for Binance Coin, the user decides to enter a position. From there, the user can continually use our tool to learn about other assets and track the performance of Binance Coin and make decisions on whether to exit their position or to increase their position. This scenario depicts how investors of all levels could use our tool to provide the relevant insights needed to make informed financial decisions in the crypto space.

4 Data

API: https://coinmarketcap.com/api/

Pulled Data: https://docs.google.com/spreadsheets/d/175PKv9skGEUY-FGxpbvgt4SXQfbHHLU7dVNZwmqJUwY/edit?usp=sharing

The data for our tool will be pulled using CoinMarketCap.com's API. While our tool will interact in real-time with the API, we have used a Google Sheets API extension to pull the data for this proposal. The API allows us to access all CoinMarketCap data on all of the assets listed on their site. It provides the relevant metrics such as trading volumes, price changes, market capitalization, and the metadata for each coin. In terms of CoinMarketCap as a company, they are the leading marketplace for cryptocurrency valuations which makes them a reliable data source for our needs. A source of bias I potentially see in this data source is that since you can buy crypto assets with another crypto asset, they are essentially double-counted in the aggregate volume, which would inflate reported volumes.

5 Implementation Plan (revised)

We plan to utilize four visualizations to build up our dashboard. The first is a pie chart, or similar visualization, which will be used to show the status of the crypto market in totality. The pie chart will show the market cap, trading volume, or circulating supply of the top 10-20 cryptocurrencies. The second visualization is a bump chart to display the chosen metrics of different currencies. Using a rank instead of the raw metric allows for an easier visualization of the variety of magnitudes. The third visualization will be a table of the metrics of each of the displayed currencies. Metrics such as price per unit, 24 hour percent change, 7 day percent change, etc. will be displayed for each currency. Users will hover over each statistic to see a description and a link to a lengthier explanation to promote education. When a user clicks on a given coin, they will be taken to a fourth visualization that will be a candlestick chart that shows the range of pricing of a coin across a given time period. The candlestick also shows the moving averages, which gives a baseline of where the price should be based on historical data. That page also includes a slider bar that shows the high and low for the day as well as the current price relative to it.

When a mouse hovers over any of the metrics on our dashboard, an information blurb will appear to educate the user on the metric they are viewing. It will define what the metrics are, as well as how to use it in their analysis. A user can toggle between the pie and bump chart to see different how the coins are behaving in the market at a given time. Additionally, a user will be able to hover over a slice of the pie or a point in the bump chart to get the exact details as well as link to the table. A user can also click on "Market Cap", "Total Volume", and "Volume" to adjust the parameters that the crypto data is analyzed on. We will need to link the smaller table shown on the initial dashboard to a larger, more in-depth, table that will exist on another page. Additionally, each coin will need to be linked to its respective candlestick page, so that when a user clicks on a coin it brings them to a new page with more information and recent news on a given coin. We are also exploring the possibility of when a user clicks on the heading of a news article, it will bring them to the article's respective webpage.

To implement our four visualizations, we will be using CoinMarketCap.com's API. We chose to use CoinMarketCap's API in particular because they are one of the leading sources for up to date data on both asset and market level data. The API will provide us with all the relevant rankings, pricing quotes, aggregate market data, and referential info needed to create the charts, sliders, and tables. The API will allow us to make thirty requests per minute, with an update frequency of one minute. By using an API we will ensure that our information is up-to-date to provide relevant information to our users.

6 Visualization Design

Our priority when designing the visualizations included ensuring beginner investors could digest the information and that there was actionable and relevant information to draw conclusions. We will be using four primary visualizations to educate investors from our crypto dashboard. A bump chart will be used to display the variety of magnitudes across different coins, and ranking them instead of plotting the raw data will result in a more straightforward chart for our users to interpret. The next

visualization in our dashboard is a pie chart to show market cap and market volume. Unlike the bump chart, the pie chart will display raw data and allow users to easily view how coins are behaving with one another in the market. Suppose a user would like to view more information on an individual coin. In that case, they can view a candlestick chart showing the high and low prices averages and predict the future prices based on historical financial data. The final visualization will be a simple table that displays a variety of coins with actionable financial data for a user to refer to. It should be noted that at the top of the dashboard, we display a variety of dense layouts (boxes) that provide an overall view of the market.

References

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[5] Tovanich, N., Heulot, N., Fekete, J.-D., & Isenberg, P. (2021). Visualization of blockchain data: A systematic review. IEEE Transactions on Visualization and Computer Graphics, 27(7), 3135–3152. https://doi.org/10.1109/tvcg.2019.2963018

Appendix A: Group Charter

Group Purpose

Our group was formed due to common interests in cryptocurrency. Although our project pitches were not all based in this field, after our discussion we decided that this was the best way to go. Our purpose is to help educate people when they are first entering the cryptocurrency market. It is a hard field to begin understanding, so we are building a dashboard that will help with that.

Group Goals

Our group's process begins each week with a check in to ensure everyone is on schedule with their roles. After that we will schedule meeting meetings as needed to maintain a constant workflow and to allow people to answer questions they have when they arise. As for quality goals, each member of the group is expected to have their portion done two days before the deadline to leave room for any questions or spur of the moment challenges that arise. The level of performance we expect from our members is as high as possible. As a collection we are shooting for an A on each step of the project. Everyone is committed to this project and achieves the best possible grade this group can get. Each team member is committing to giving 4 hours of work to this project a week.

Group Member Roles/Responsibilities

Everyone in this group is responsible for the whole project however, we have broken up special roles for each person. The first role is Evan Eddleston who is our group leader/communications director. Their role is to ensure everyone knows each deadline as well as set up meetings and make sure everyone is available for each meeting. The second role is Nick Ryu who is our technical lead/dataset manager. While everyone is responsible for the technical analysis, the dataset manager is the point of contact if anyone has any questions about the dataset. The third role is John Treppo who is our documentation coordinator. He is responsible for making all documents and when in meetings taking notes. He also is the lead on any editing or revising. The final role is Wilson King who is our project management leader. This role entails he is responsible for any interior problems and holding people accountable. If people are not meeting the requirements assessed in this group

charter, he will let them know and ensure they change their actions. He is also the person you go to if there are interior problems that need to be addressed anonymously.

Ground Rules

As stated previously, we will meet on Monday of each week to go over what we expect to get done each week. This will be a 30 minute catch up meeting where people can ask questions, state opinions, and update the rest of the group on their progress. Each week the group leader will create an agenda of what should be done and what needs to be completed. Then two days before the deadline the group leader will reach out again and everyone will update him on their progress. If needed at this point any member can ask that we have another meeting in which the group leader will find a time that would work for everyone and schedule it. As for any dissenting members the project manager will be keeping a close eye on everyone's performance to ensure that they are up to par. If there are any problems in the group everyone should feel free to voice their opinions, however if they would like to voice something anonymously, they can contact the project manager and they will make the qualm known. If there are any problems with the project manager, people should feel free to reach out to the group leader to handle these problems. As for participation level and commitment, people are asked to spend at least 4 hours a week on this project starting on February 28, 2022.

Potential Barriers and Coping Strategies

The largest example all of us have seen in the past is lack of effort from a group member. In our initial meeting we were sure to address this and make sure everyone felt comfortable asking people to do more if they feel as though they are slacking. The main reason we are having the weekly meeting is to divide work and ensure that everyone feels like they are doing a fair amount of work. The biggest thing is we do not want people to feel overstretched with their workload. In our roles we have two people who are responsible for ensuring that everyone is on board with the same plain. Firstly, the project manager however he will be working closely with the group leader to ensure that there are no problems. At the end of the day it all comes down to making sure people feel free to voice any opinion they have, if we can accomplish this goal we should not run into any problems.

Group Charter Update

Our group has been working efficiently throughout this project. Every person has been abiding by their role and helping out others when help is needed. While group roles are still in effect as the project becomes more technical the roles have been taking a side step to help with the different technical parts of this project. It has been great to see people helping each other out as much as they are. There have been no problems that have needed to be addressed. Any disagreements over aspects of the project have been handled in a cordial manner allowing for our group to continue to move without a hitch.

	About Wilson	About Evan	About Nick	About John
Wilson says		Lead the charge on the data exploration section and helped provide explanation on those items when needed	His design sketches were clear and concise; we used a lot of his in our final sketch.	Lead a great interview with our client. He was able to ask the hard hitting question which helped us determine what we need to put into our visualizations.
Evan says	Great organization and helps to make sure everyone is on task and knows what is going on at all times..		Extremely helpful on the data review section. He knows data types, marks and can explain the data better than anyone I know	He was the point man for converting the actual interview into actionable information.
Nick says	He was responsible for finding really good sources that were very helpful and allowed us to	Takes great leadership and keeps the group organized. Definitely our lead ideas guy.		Great writing throughout and has done a great job editing other people's work as well.

	formulate a good project proposal.		[redacted]	
John says	Wilson was the point person for the charter and helps to keep the group on pace the whole time.	Evan was a huge component of figuring out how to turn raw ideas into an actual project, mainly through the implementation section.	Creates and finds the best graphics and understands our content the best	[redacted]

Appendix B: Data Exploration

Data Review

After initially reviewing our data, the majority of the key datum are either sequential or diverging quantitative data as it mostly consists of financial metrics. Distinguishing factors of this dataset include the magnitude of assets we can pull data for, as well as the ranges and variance in the data as seen in the table below . It will be key throughout this project that we make the data seem relevant and digestible to our users, considering we are looking at people who are just beginning in this space. For this specific data review, we chose to limit the results to the top 100 by market capitalization as it is the industry standard for rankings

Datum	***Type***	***Description***	***Statistics***
market_cap	*Sequential quantitative data*	*The circulating supply multiplied by the current asset price.This number is very reliant on both circulating supply and current asset price and subject to change frequently.*	**Mean:** 18778645194 **Median:** 1935194518 **Max:** 837401873032 **Min:** 655237049.6 **Total:** 1877864519417
name	*Categorical data with levels being all of the different names.*	*The cryptocurrency name.*	**Total:** 100 * Limited for this initial analysis
symbol:	*Categorical data with levels being all the varying symbols.*	*The shorthand version of the asset name*	**Total:** 100 * Limited for this initial analysis
date_added:	*Ordinal data with two different levels. The first is time which is cyclical around a 24 hour clock and the second is data which is sequential.*	*Date cryptocurrency was added to the system.*	
price	*Sequential quantitative data*	*Latest average trade price across markets.*	**Mean:** 2059.622172 **Median:** 3.596940948 **Max:** 44139.09239 **Min:** 0.000001993115443
circulating_supply	*Sequential quantitative data.*	*Approximate number of coins currently in circulation*	**Mean:** 15015145732718 **Median:** 513504780.3 **Max:** 932497500000000 **Min:** 14907.69011
total_supply:	*Sequential quantitative data.*	*Approximate total amount of coins in existence right now (minus any coins*	**Mean:** 359352877855 **Median:** 1000000000

		that have been verifiably burned).	**Max:** 21000000000000 **Min:** 13698
max_supply	*Sequential quantitative data.*	*Approximation of the maximum amount of coins that will ever exist in the lifetime of the currency*	**Mean:** 359352877855 **Median:** 1000000000 **Max:** 21000000000000 **Min:** 13698
num_market_pairs	*Sequential quantitative data*	*Number of market pairs across all exchanges trading each currency.*	
volume_24h	*Sequential quantitative data*	*Rolling 24 hour adjusted trading volume.*	**Mean:** 1943289411 **Median:** 204694338.5 **Max:** 75817258811 **Min:** 6250393.39
volume_changed_24h	*Diverging quantitative data*	*Rolling 7 day adjusted trading volume.*	**Mean:** 23.721854 **Median:** 11.2981 **Max:** 523.5441 **Min:** -44.7407
percent_change_1h	*Diverging quantitative data*	*1 hour trading price percentage change for each currency.*	**Mean:** 0.3829113949 **Median:** 0.25689889 **Max:** 7.41946004 **Min:** -0.79677522
percent_change_24h	*Diverging quantitative data*	*24 hour trading price percentage change for each currency.*	**Mean:** 1.896820239 **Median:** 0.961228275 **Max:** 36.50963725 **Min:** -4.48561063
percent_change_7d	*Diverging quantitative data*	*7 day trading price percentage change for each currency.*	**Mean:** 10.77113007 **Median:** 9.213592145 **Max:** 98.5225834 **Min:** -10.28601693
percent_change_30d	*Diverging quantitative data*	*30 day trading price percentage change for each currency.*	**Mean:** 6.387867202 **Median:** 2.707360545 **Max:** 142.839489 **Min:** -29.14194512
percent_change_60d	*Diverging quantitative data*	*60 day trading price percentage change for each currency.*	**Mean:** -23.07286059 **Median:** -23.63783882 **Max:** 57.4313055 **Min:** -61.34340338
percent_change_90d	*Diverging quantitative data*	*90 day trading price percentage change for each currency.*	**Mean:** -33.20051922 **Median:** -38.22417112 **Max:** 78.7559736 **Min:** -69.96851299

Potential Issues

- ***Amount of coins in dataset****: There are over 10,000 assets pulled into our dataset, if we want to make this information easily digestible for our newer audience there is no reason to have this many assets. Many of these assets are projects that are not going to be successful, so our solution will be to limit the number of assets to the top 100 by market capitalization.*
- ***Frequently Changing Data:*** *Due to the fact that we are tracking a live market our data changes by the second. Therefore, in order to solve this issue we will have to connect our visualization to the API so that it is always updating*

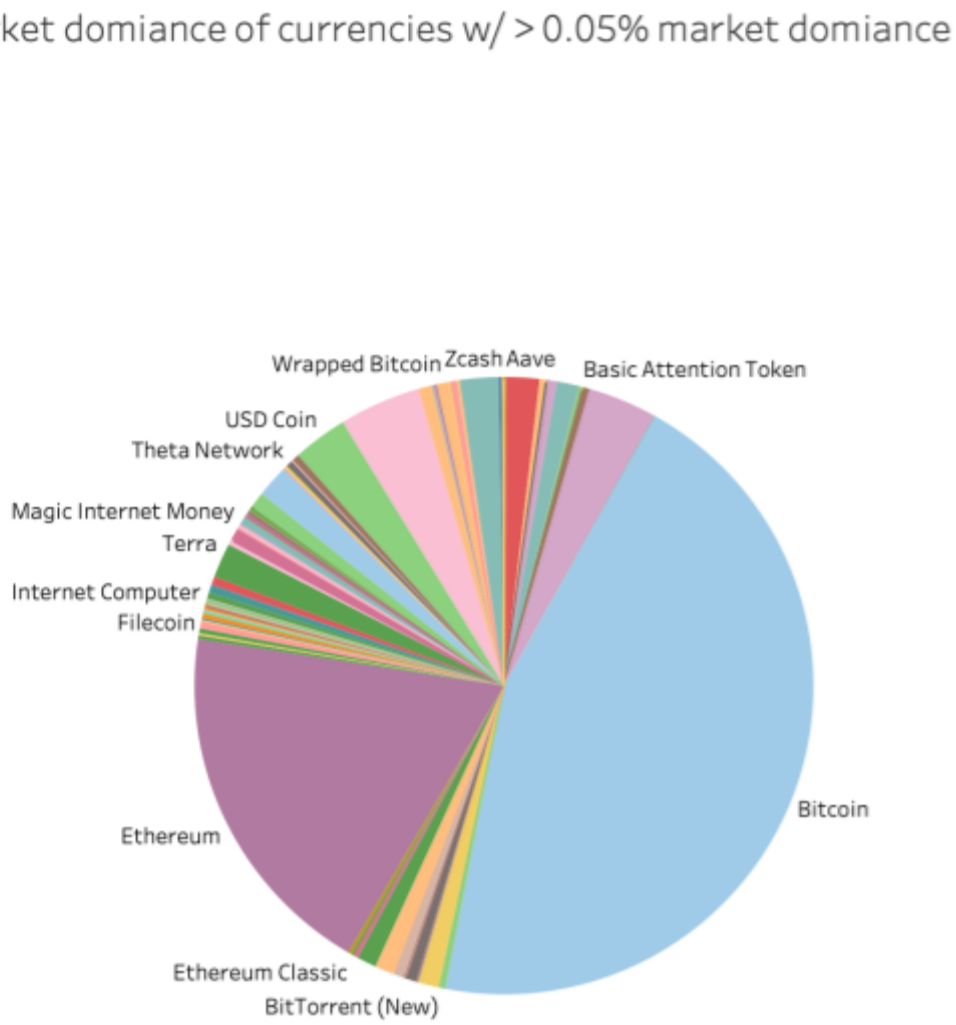
or download one API and use that as our data. The first option is the primary method, however if that does not work we will change our dashboards to be more of an example of how to deal with the cryptocurrency field.

- ***Numbers are Large:*** *Our goal of making this dashboard is to make educational dashboards that are easily digestible for a variety of viewers. We are going to focus on making the numbers tangible and make it so that newer users are able to understand what is on our dashboards.*
- **Large contrast between values:** The best example of this issue is with the price metric. The majority of coins are priced below $0.05 while the few reputable ones hover around the $10,000 mark. This makes scaling of axes in visualizations difficult, we will need to balance readability with correctly demonstrating the differences in value.

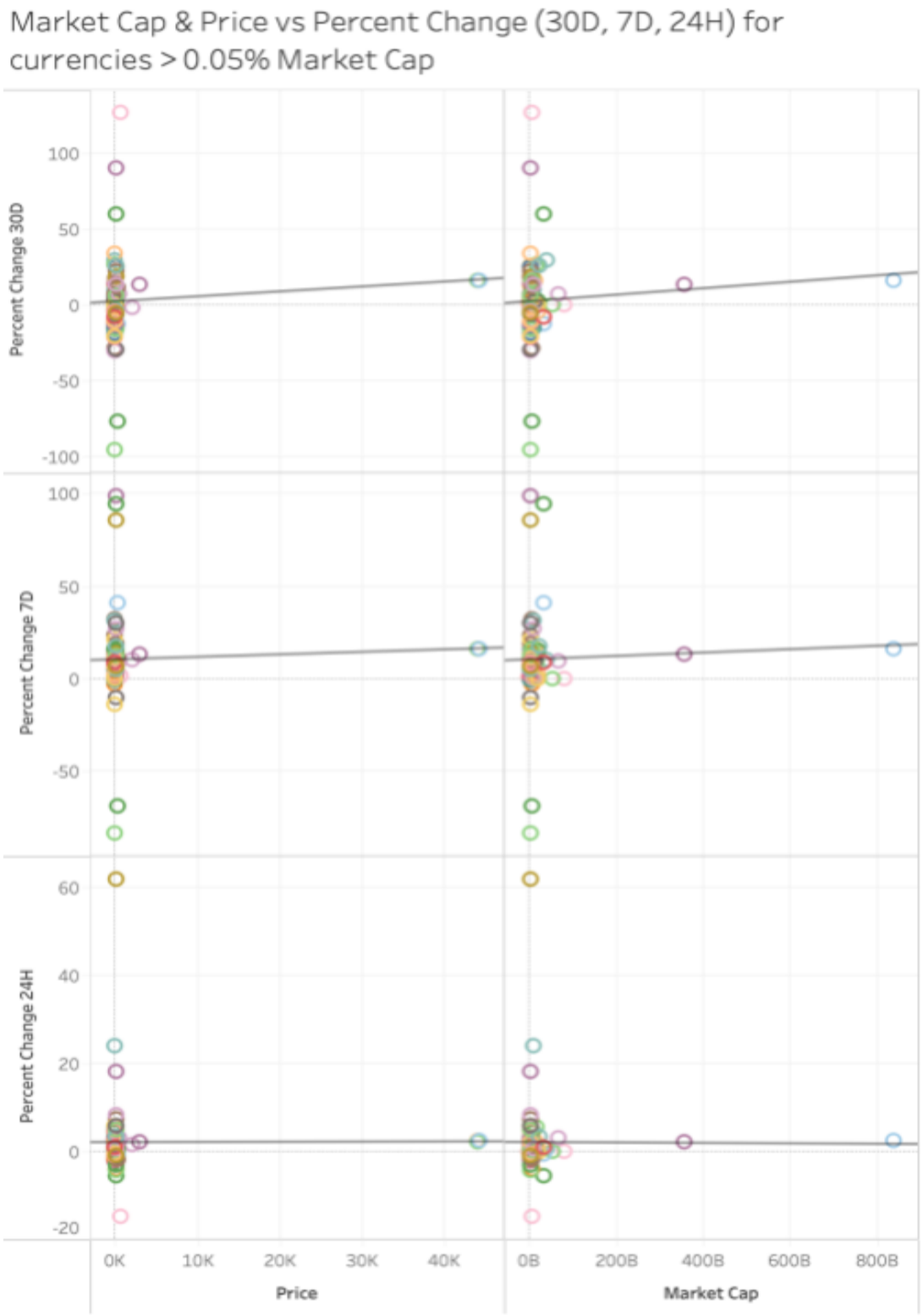
Data Insights

As we began combing through the data, we quickly realized that we would need to narrow down our parameters, as the API pulls all active cryptocurrency market data. For this analysis, we limited it to the top 100 assets by market cap. We choose to use market cap as it gives an outlook on the stability and trust people have in an asset, as well as being the industry standard. Something that surprised us was the dominance the top assets have. The top asset, Bitcoin, accounted for 44.6% of the total market cap alone and the top 3 combined accounted for almost 70% of the total global market cap. We also noticed significant variance in the mean, median, maximum, and minimum statistics across price, circulating supply, total supply, and max supply. As these are four of the most significant factors in cryptocurrency tokenomics, we believe it is reflective of the different approaches these assets are taking to solving similar financial problems. This may cause a potential obstacle for us as we will need to be able to educate the user to not look at the metrics only in comparison to other assets but also in comparison to their tokenomics and strategy.

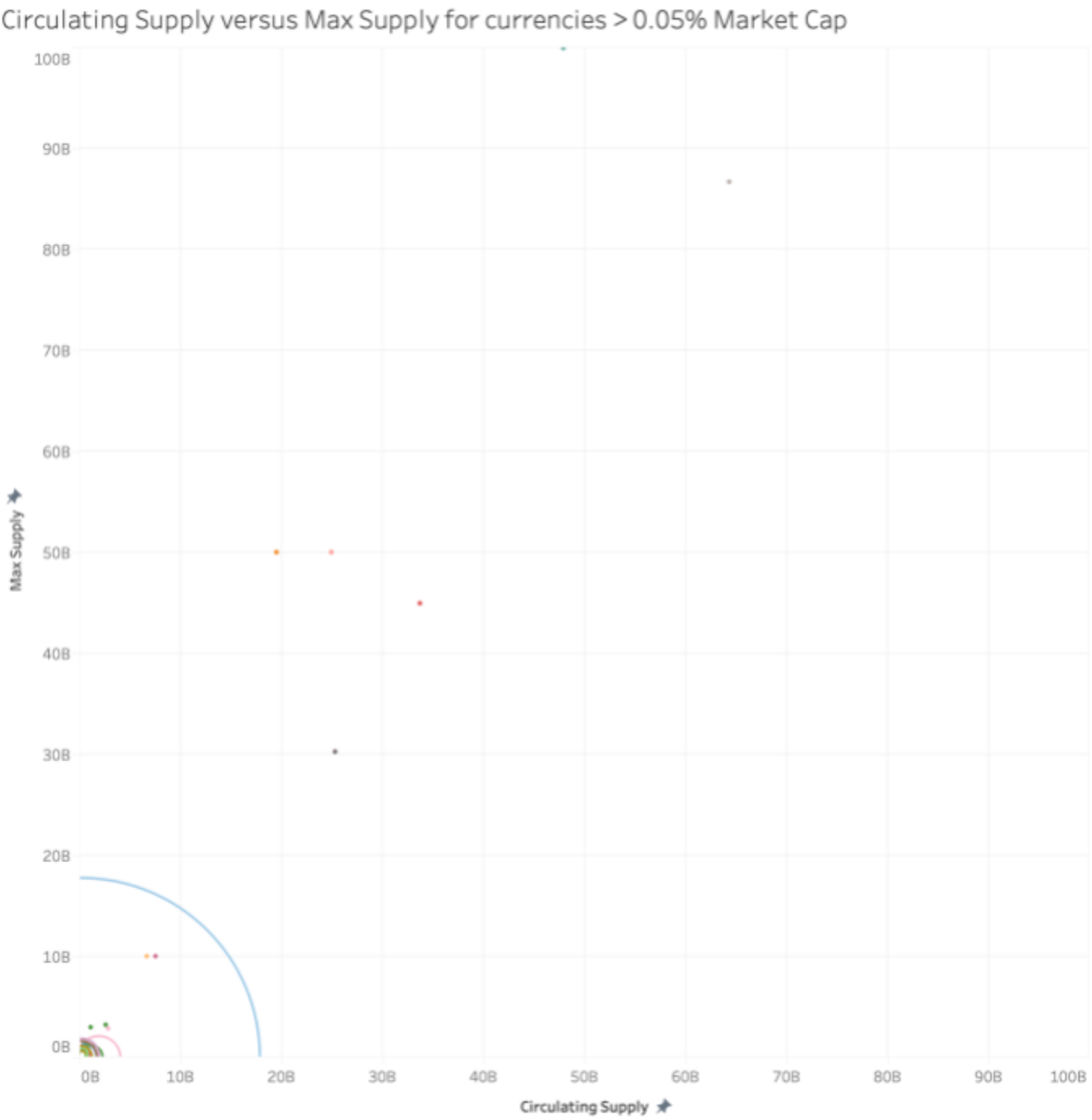
Data Exploration



Displayed above is the percentage market share dominance of the currencies with above 0.05% market share dominance. The filtering cuts down the ~9,000 currencies to 84 currencies. The pie chart is used to visually display the difference in magnitudes of market share. A pie chart works well due to the data being shown as a percentage of a whole. There is no blaring trend outside the market being dominated by 3 major currencies; Bitcoin, Ethereum, and Tether.



Displayed above is a matrix of scatter plots of Market Capitalization & Price versus percent change in price for 30 day, 7 day, and 24 hour time periods. Used a scatter plot to show the relationship between two measures. We added a trend line to assist in identifying a relationship. The similarities between the price and market cap make sense since market cap is derived from the price of the security. A trend we identified is that the lower price currencies have much more variance and are less stable than the already unstable crypto 'blue chips'.



Displayed above is a scatter plot of the circulating supply of a currency versus their theoretical msx supply. The same filtering of >0.05 market cap police is used again to trim down ~9,000 currencies to a more manageable quantity. From plotting circulating supply versus max supply we can see that the majority of crypto currencies have not reached their max supply yet. The trend line of the plots would appear to have a > 1 slope. Another visual encoding we used is the size of each point. This does a good job demonstrating some of the issues with the data. Currencies have a wide range of supplies and prices.

Data Snippet

data.name	data.symbol	data.slug	t_pairs	data.date_added	y	supply	y	data.cmc_rank	d	price	volume_24h	volume_change	percent_change
Bitcoin	BTC	bitcoin	9191	2013-04-28T00:00:00.000Z	21000000	18971887	18971887	1	2022-03-01T23:24	44139.09239	32428928896	-7.7112	0.57866239
Ethereum	ETH	ethereum	5527	2015-08-07T00:00:00.000Z		119785607.1	119785607.1	2	2022-03-01T23:24	2960.451941	18812302908	-2.1149	0.21763391
Tether	USDT	tether	28914	2015-02-25T00:00:00.000Z		79416066408	82164697049	3	2022-03-01T23:24	1.000387478	75817258811	6.2105	-0.00488993
BNB	BNB	bnb	730	2017-07-25T00:00:00.000Z	165116760	165116760.9	165116760.9	4	2022-03-01T23:24	406.6558531	2890686590	56.5945	0.04263812

Task Analysis

Task ID #	*Domain Task*	*Analyze Task (high-level)*	*Search Task (mid-level)*	*Analytic Task (low-level, "query)*
1	I want the visualization to show not only the important metrics, but also why they are important	Consume → Present	Lookup	Summarize
2	I want the dashboard to teach basic financial analysis	Consume → Present	Browse	Identify
3	I want the visualization to show a variety of reputable sources for updated news	Consume → Discover	Explore	Compare

Who will be the primary consumer of your visualization?
Our visualization will primarily be people who are brand new to the cryptocurrency space. Our goal will be to teach them the skills to safely navigate this industry. Generally people who are using our visualization will be using it on a personal level as opposed to corporate or business level.

For which type of consumption (Discover, Present, Enjoy) will your visualization be primarily developed? Please justify your answer.
Our visualization will primarily be developed for the present consumption type. Our visualization is made to show our consumer different ways to understand different coins or inform them of places to find more information. While there will be some discovery the objective is that they learn different tactics and are able to use them in other places after. There will be a significant amount of explaining and once they have understood these explanations they will be able to send graphics of why they work.

Appendix C: Interview

Interview Script

Introduction:

- Discuss the purpose of the project and interview. Also, ask permission for recording.

Background:

- Can you speak a little about yourself? Such as your profession, age, and where you're from.
- Now can you talk a little about how your experience in cryptocurrency?
    - Probe on how they first entered the crypto space and how they got to where they are today.
        - Note: *let them speak for themselves here, we are just trying to get a summary and have them explain to us. We can probe in later sections.*

Experience before entering crypto:

- What was your financial knowledge before trading cryptocurrencies?
    - How they gained this knowledge and how much time they spent
    - Probe on if they had a heavy financial background (e.g., stocks, investment banking, etc.)
- What type of financial figures/visualization were you familiar with before entering the crypto market?
    - How did you become familiar with these figures?
    - What was the purpose of these figures?
- What led you to start investing in crypto?
    - How much research did you conduct before putting your initial capital in the crypto market?

Experience as a beginner crypto trader:

- Please describe three positive aspects of your initial journey of understanding the crypto market?
- Please describe three pain points in the process of understanding the crypto market?
- What visualizations/figures of the crypto market did you recognize from past experiences?
    - What type of emotions did you have when you first encountered these figures?
    - When you encountered the figures you understood, what happened next?
        - Probe on how they used them and if they kept referring to the same figures that they understood
- What visualizations/figurea of the crypto market did you not recognize from past experiences?
    - What type of emotions did you have when you first encountered these figures?
    - When you encountered the figures you did not understand, what happened next?
        - Probe on how they tried to learn to use them or if they abandoned them and the data accompanying it
            - Why did you or did you not learn how to interpret the visualization?
- At what point in your crypto trading ability? (AKA you don't feel like a complete novice)

Experience as an intermediate crypto trader:

- Can you explain your current workflow in how you trade crypto coins
    - What visualizations do you most use today and why?
        - How did you come to understand these visualizations?
        - Are these visualizations common? (e.g., found on Coinbase)
- What tools do you use to help in your crypto trading?
- Please describe three positive aspects in the way you buy and sell crypto today
- Please describe three pain points in the way you buy and sell crypto today
- Where do you get the majority of your information/knowledge on crypto today?

How you plan to become an "expert" crypto trader:

- Where do you see your crypto experience evolving in the next 1-2 years?
- What information/tools do you wish you understood about crypto?
- What would have to occur that would make you feel like an "expert" in the crypto field?
- Is there anything we should've asked you or information we didn't touch on that you believe would be helpful in the creation of our educational crypto dashboard?

Interview Notes

Introduction:

Question : Discuss the purpose of the project and interview. Also ask permission for recording. Hi, today I will be asking you a couple of questions about cryptocurrencies and your experience as an investor. We are conducting these interviews to develop a dashboard to help beginner-intermediate level traders get into the space. I want to thank you in advance for taking the time to answer some questions for us.

Background:

Question : Can you speak a little about yourself? Such as your profession, age, and where you're from.

Answer: Sure thing. My name is Brian and I am from New York. I am currently a 4th year communications student. I plan on working at a production house or on a corporate marketing and advertising team once I graduate.

Question : Now can you talk a little about your experience in crypto currency?
- Probe on how they first entered the crypto space and how they got to where they are today.
- Note: *let them speak for themselves here, we are just trying to get a summary and have them explain to us. We can probe in later sections.*

Answer: I have been investing in stocks for about a year or two now and got into crypto maybe a few months ago because of all the articles coming out about decentralized finance and bitcoin. It was definitely a rough start at first because I honestly didn't really know where to start. I ended up just reading a bunch of articles and videos until I had a grasp on it. I've also joined the blockchain club here so that has helped me meet new people and learn more about the space.

Experience before entering crypto:

Question : What was your financial knowledge before trading crypto currencies?
- How they gained this knowledge and how much time they spent
- Probe on if they had a heavy financial background (e.g., stocks, investment banking, etc.)

Answer: Before getting into crypto, I had traded stocks on and off for about two years. It wasn't anything crazy but I would stay up to date with the news and learn about technical analysis but I wouldn't call myself advanced in any finance areas.

Question : What type of financial figures / visualization were you familiar with before entering the crypto market?
- How did you become familiar with these figures?
- What was the purpose of these figures?

Answer: I was familiar with the basics. I knew about the candlestick charts, along with the indicators such as moving averages from my experience with stocks. With that I also had an understanding of market capitalization and macro factors. When I got into crypto, the visualizations were a bit different so I taught myself about the differences through mostly youtube videos.

Question : What led you to start investing in crypto?
- How much research did you conduct before putting your initial capital in the crypto market?

Answer: I started investing in crypto mainly because my friends got started in it and I would see a lot of articles from sources I followed like Business Insider. Before making my first crypto investment, I honestly probably didn't do that much research. I just fed into the hype. However, now I try to spend at least a few days researching projects before investing in them.

Experience as a beginner crypto trader:

Question : Please describe three positive aspects in your initial journey of understanding the crypto market?

Answer: One aspect is definitely the people I have met. I have met other students and people in general that share the same interest and help each other grow and learn more. A second positive aspect is that it has opened up career opportunities in an industry that I had never considered prior. I always thought I would only do advertising but now I am also considering roles in the crypto space. A final aspect that I have enjoyed is that it gave me much more financial awareness about my portfolio and my plan for the future.

Question : Please describe three pain points in the process of understanding the crypto market?

Answer: One pain point is that many articles will tell you that a metric is important but not why it is important. A second pain point is that there is so much information that it is overwhelming to get started. A final pain point is that new articles and headlines come out every day so it is hard to stay on top of it and in the loop.

Question : What visualizations / figures of the crypto market did you recognize from past experiences?
- What type of emotions did you have when first encountered these figures?
- When you encountered the figures you understood, what happened next?
- Probe on how they used them and if they kept referring to the same figures that they understood

Answer: From past experiences, I remember the candlestick charts and the market cap graphs. When I first saw them, it was a bit of a relief but I also remembered the countless hours I've spent staring at these charts. If I ever encountered a chart or visualization I didn't understand, I would usually look up an article or video on it.

Question : What visualizations / figures of the crypto market did you not recognize from past experiences?
- What type of emotions did you have when first encountered these figures?
- When you encounter figures you did not understand, what happens next?
- Why did you or did you not learn how to interpret the visualization?
- Probe on how they tried to learn to use them or if they abandoned them and the data accompanying it.

Answer: One visualization that I did not recognize was the order books. In stocks there are visualizations for volume but it is often not broken down to the individual orders. When I first encountered it, it made me feel curious about what it was and what it indicated. I learned about it through watching an explainer youtube video.

Question : How confident are you about your crypto trading ability? (AKA you don't feel like a complete novice)

Answer: I would say I am at an intermediate level. I am definitely not competing with firms but I feel that I am slightly more knowledgeable than the typical retail investor. I believe I am lacking some technical knowledge.

Experience as an intermediate crypto trader:

Question : Can you explain your current workflow in how you trade crypto coins?
- What visualizations do you most use today and why?
- How did you come to understand these visualizations?
- Are these visualizations common? (e.g., found on Coinbase)

Answer: I begin by reading the assets whitepaper. From there I will watch some videos on the project and make a pros and cons list. After that, I will look at how it is performing on the coin market cap. Once I have a strong feeling about it, I will track it through a trading view to find the ideal time to enter a position. The main visualization I use is candlesticks which is the standard for technical analysis.

Question: Can you talk a little more about why you like to use candlesticks perhaps more than other visualizations?

Answer: Yeah sure, I mean I've used these so much in my finance classes and they provide a great snapshot of the asset and how it behaves in the market. I am just confident in my ability to analyze it and know I won't make any mistakes.

Question : What tools do you use to help in your crypto trading?

Answer: The main tools I use are Coinmarketcap.com, to get an overall view and daily changes, and trading view, to view candlestick charts and conduct technical analysis.

Question : Please describe three positive aspects in the way you buy and sell crypto today?

Answer: A positive aspect is that there is a specific path to follow. A second aspect is that it allows me to get an overall view of the market as well as an asset specific view. And a third positive aspect would be that it exposes me to knowledge in the macro space that affects crypto as well as other markets.

Question : Please describe three pain points in the way you buy and sell crypto today?

Answer: One pain point is that coin market cap can sometimes be overwhelming with the amount of assets they report on. A second pain point is that I have to keep track of multiple metrics for multiple assets at any given time. A third pain point would be that it is very time consuming.

Question : Where do you get the majority of your information / knowledge on crypto today?

Answer: I get most of my information from youtube videos and reading articles. I also learn a lot from exchanging information in groups or in discord servers.

How you plan to become an "expert" crypto trader:

Question : Where do you see your crypto experience evolving in the next 1-2 years?

Answer: In the next 1-2 years, I believe it will be a period heavily influenced by institutional investors. Crypto is becoming more and more mainstream and I can definitely see more firms joining in as well as more businesses starting to accept the currency.

Question : What information / tools do you wish you understood about crypto?

Answer: I wish I had a deeper understanding of the financial analysis aspects. I have a basic understanding but there are sometimes metrics and indicators that go over my head.

Question : What would have to occur that would make you feel like an "expert" in the crypto field?

Answer: To feel like an expert in the crypto field, I would probably have to make a lot of money or be hired by a company to truly feel that I was an expert.

Question : Is there anything we should've asked you or information we didn't touch on that you believe would be helpful in the creation of our educational crypto dashboard?

Answer: The only thing I would say is that if your dashboard is focused on beginner to intermediate level investors, is to make it as simple as possible and to explain everything. Something may be obvious to you but it likely isn't for a lot of people.

Interview Results

Introduction:

Question : Discuss the purpose of the project and interview. Also ask permission for recording. Hi, today I will be asking you a couple of questions about cryptocurrencies and your experience as an investor. We are conducting these

interviews to develop a dashboard to help beginner-intermediate level traders get into the space. I want to thank you in advance for taking the time to answer some questions for us.

Background:

Question : Can you speak a little about yourself? Such as your profession, age, and where you're from.

Summary: 4th year communication student from New York. Plans to work at production house or in marketing.

Question : Now can you talk a little about your experience in crypto currency?
- Probe on how they first entered the crypto space and how they got to where they are today.
- Note: *let them speak for themselves here, we are just trying to get a summary and have them explain to us. We can probe in later sections.*

Summary: Novice to the Crytpo space (few months) has foundatrional finance knowledge. Intrigued by general buzz learned through wathicng youtube videos and reading articalas. Was difficult to know where to start

Experience before entering crypto:

Question : What was your financial knowledge before trading crypto currencies?
- How they gained this knowledge and how much time they spent
- Probe on if they had a heavy financial background (e.g., stocks, investment banking, etc.)

Summary: Base line Finnace knowledge

Question : What type of financial figures / visualization were you familiar with before entering the crypto market?
- How did you become familiar with these figures?
- What was the purpose of these figures?

Summary: Taught himself the differences and nuances between traditional finance visualizations and crypto visualizations

Question : What led you to start investing in crypto?
- How much research did you conduct before putting your initial capital in the crypto market?

Summary: Became interested due to the hype and buzz behind crypto, Did not do much research before making the first investment

Experience as a beginner crypto trader:

Question : Please describe three positive aspects in your initial journey of understanding the crypto market?

Summary:
- People
- New carrer opportunities
- Finnacial opportunities

Question : Please describe three pain points in the process of understanding the crypto market?

Summary:
- Metrics are told to be important but are not explained
- Over whelming to start learning
- Pace of information is intimidating

Question : What visualizations / figures of the crypto market did you recognize from past experiences?
- What type of emotions did you have when first encountered these figures?
- When you encountered the figures you understood, what happened next?
- Probe on how they used them and if they kept referring to the same figures that they understood

Summary: Remembered candlesticks charts and market cap graphs, took a while to understand the differences

Question : What visualizations / figures of the crypto market did you not recognize from past experiences?
- What type of emotions did you have when first encountered these figures?
- When you encounter figures you did not understand, what happens next?
- Why did you or did you not learn how to interpret the visualization?
- Probe on how they tried to learn to use them or if they abandoned them and the data accompanying it.

Summary: Order books were a new viualization, learned about it through a youtube video

Question : How confident are you about your crypto trading ability? (AKA you don't feel like a complete novice)

Summary: Intermediate level, know more about the average investor, but not competing with firms. Feels he lacks technical knowledge

Experience as an intermediate crypto trader:

Question : Can you explain your current workflow in how you trade crypto coins?
- What visualizations do you most use today and why?
- How did you come to understand these visualizations?
- Are these visualizations common? (e.g., found on Coinbase)

Summary: Begin by reading the assets whitepaper. Then will watch videos of the project (both positive and negative) After that, look at how it is performing on the coin market cap. As confidence grows and he begins to track and find the ideal time to enter a position. The main visualization used is candlesticks which is the standard for technical analysis.

Question: Can you talk a little more about why you like to use candlesticks perhaps more than other visualizations?

Summary: Used them in past finance courses, so became confident in using them.

Question : What tools do you use to help in your crypto trading?

Summary: The main tools used are Coinmarketcap.com, to get an overall view and daily changes, and trading view. He views candlestick charts and conduct technical analysis.

Question : Please describe three positive aspects in the way you buy and sell crypto today?

Summary: A positive aspect is that there is a specific path to follow. A second aspect is that it provides an overall view of the market as well as an asset specific view. And a third positive aspect is the exposure to knowledge in the macro space that affects crypto and other markets.

Question : Please describe three pain points in the way you buy and sell crypto today?

Summary: Coin market cap can be overwhelming with the amount of assets they report on. A second pain point is keeping track of multiple metrics for multiple assets. A third pain point is the time needed to stay up to date on crypto.

Question : Where do you get the majority of your information / knowledge on crypto today?

Summary: Discord servers, youtube videos, and reading articles online.

How you plan to become an "expert" crypto trader:

Question : Where do you see your crypto experience evolving in the next 1-2 years?

Summary: Crypto is becoming more and more mainstream and could see more firms accept cryptocurrency as payment. He thinks crypto will be led by the “insitututional investors”

Question : What information / tools do you wish you understood about crypto?

Summary: Deeper understanding of financial figures.

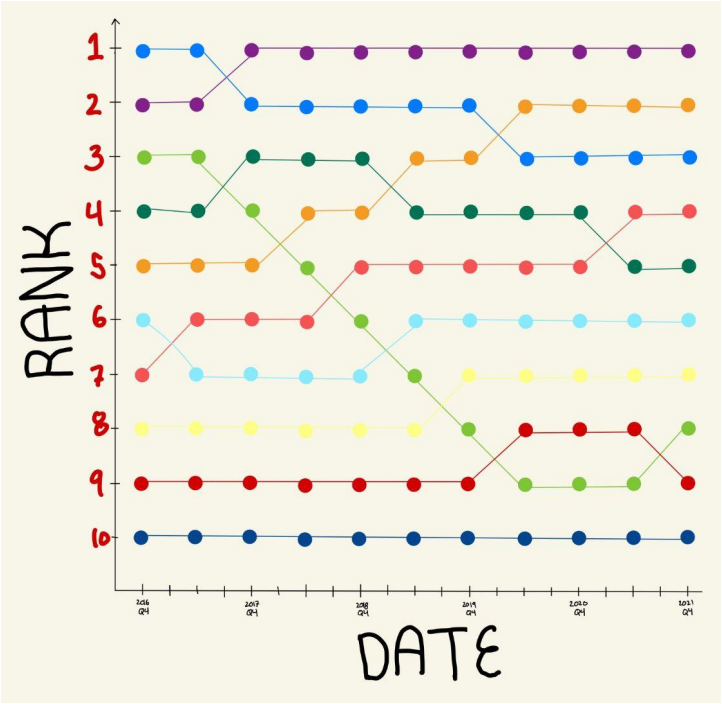
Question : What would have to occur that would make you feel like an “expert” in the crypto field?

Summary: Have to make a lot of money or work in the crypto industry.

Question : Is there anything we should’ve asked you or information we didn’t touch on that you believe would be helpful in the creation of our educational crypto dashboard?

Summary: If dashboard is focused on beginner to intermediate level investors, make it simple to explain everything. “Something may be obvious to you but it likely isn’t for a lot of people”

Appendix D: Design Sketches

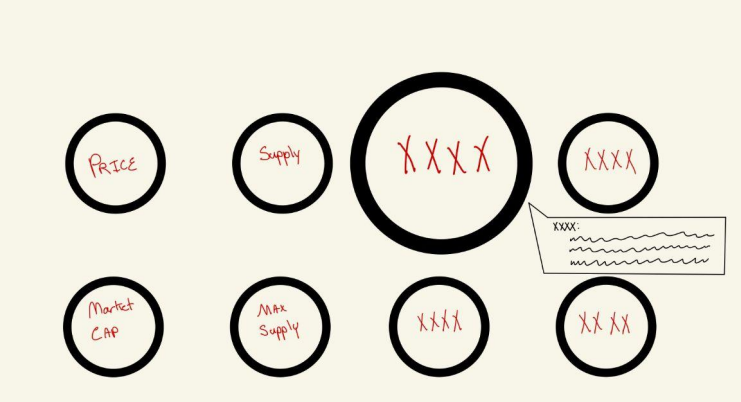


John Treppo

FAVORITE: This visualization accomplishes task 1 of our task table. I chose to use a bump chart to display the chosen metrics of different currencies. Using a rank instead of the raw metric allows for an easier visualization of the variety of magnitudes. In our explorations we noticed that the magnitudes differed crunching data into one section of the visualization. This made time series charts hard to decipher and understand. By using a bump chart, time series is possible to display in a meaningful way.

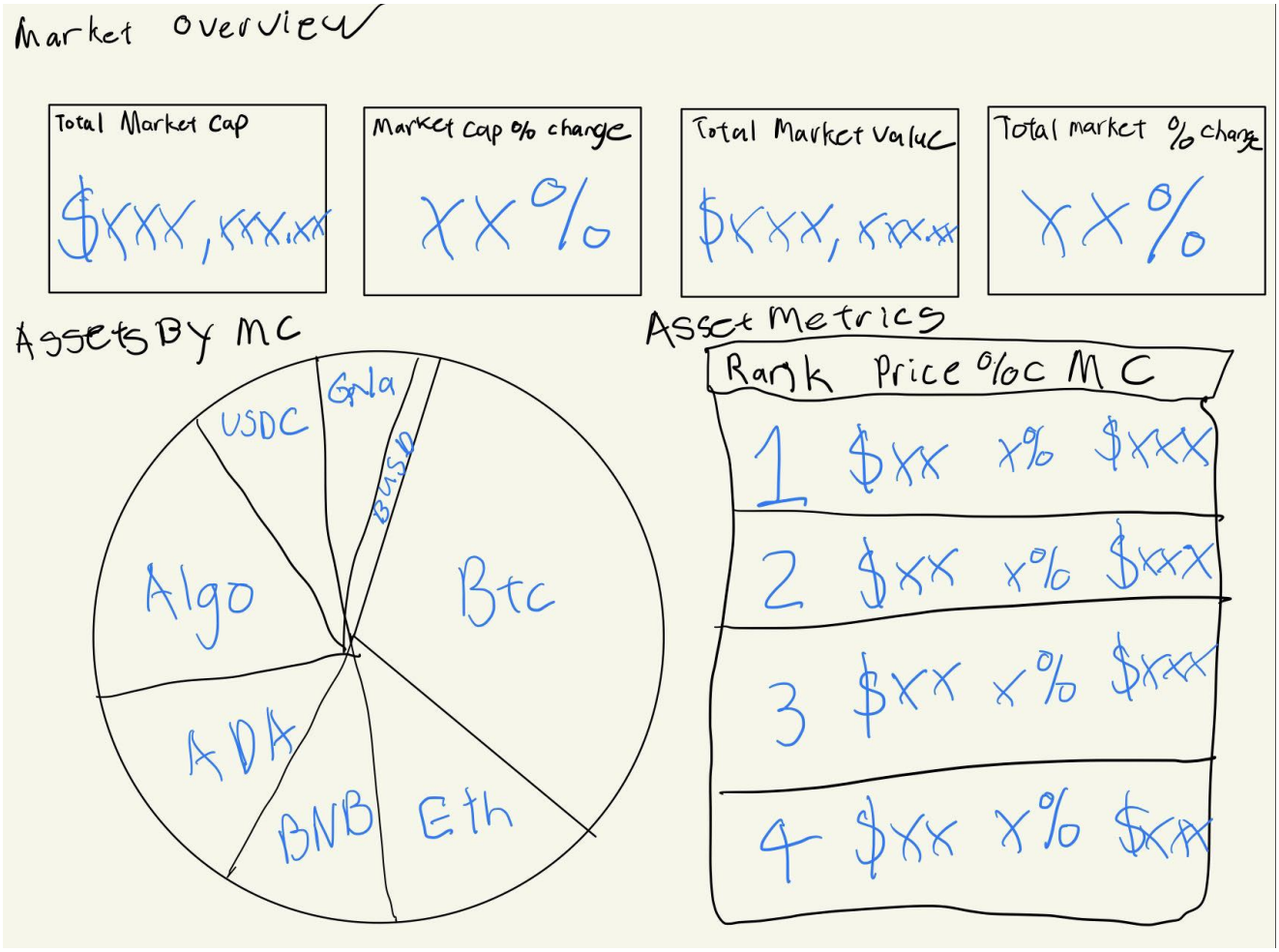
John Treppo

The visualization accomplishes task 1 of our task chart. Its purpose is to work in tandem with the above bump chart. Each security and its key metrics will be displayed with the corresponding color and rank. Additionally, the metric being displayed in the bump chart will be highlighted for easier identification.



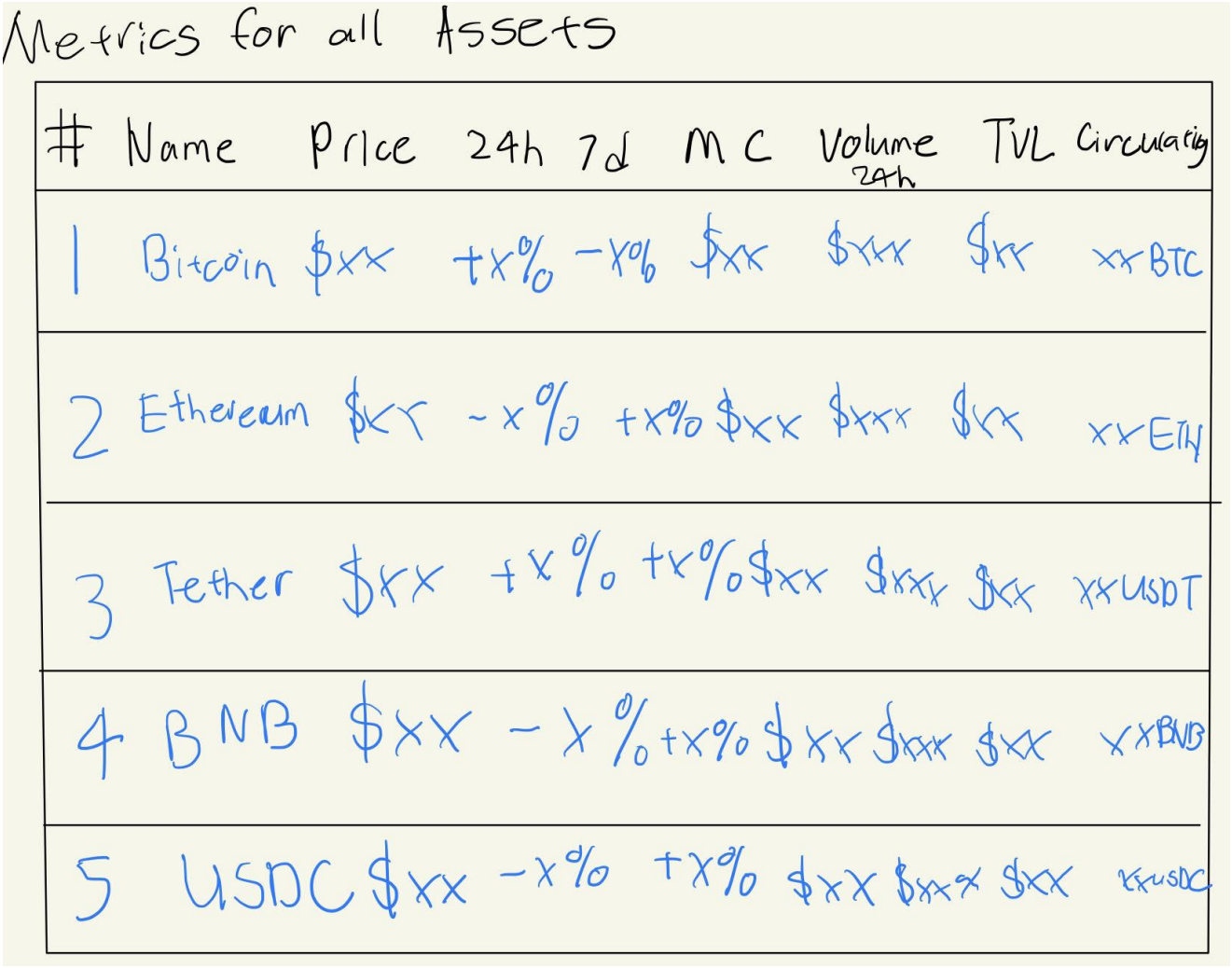
John Treppo

This visualization accomplishes task 2 of our task table. The visual uses a dense layout to display the different metrics we intend to use. When a metric is hovered over the size increase as well as displaying a pop up which will give context to what the metric is, how it is used, why it is important and a URL to learn more.



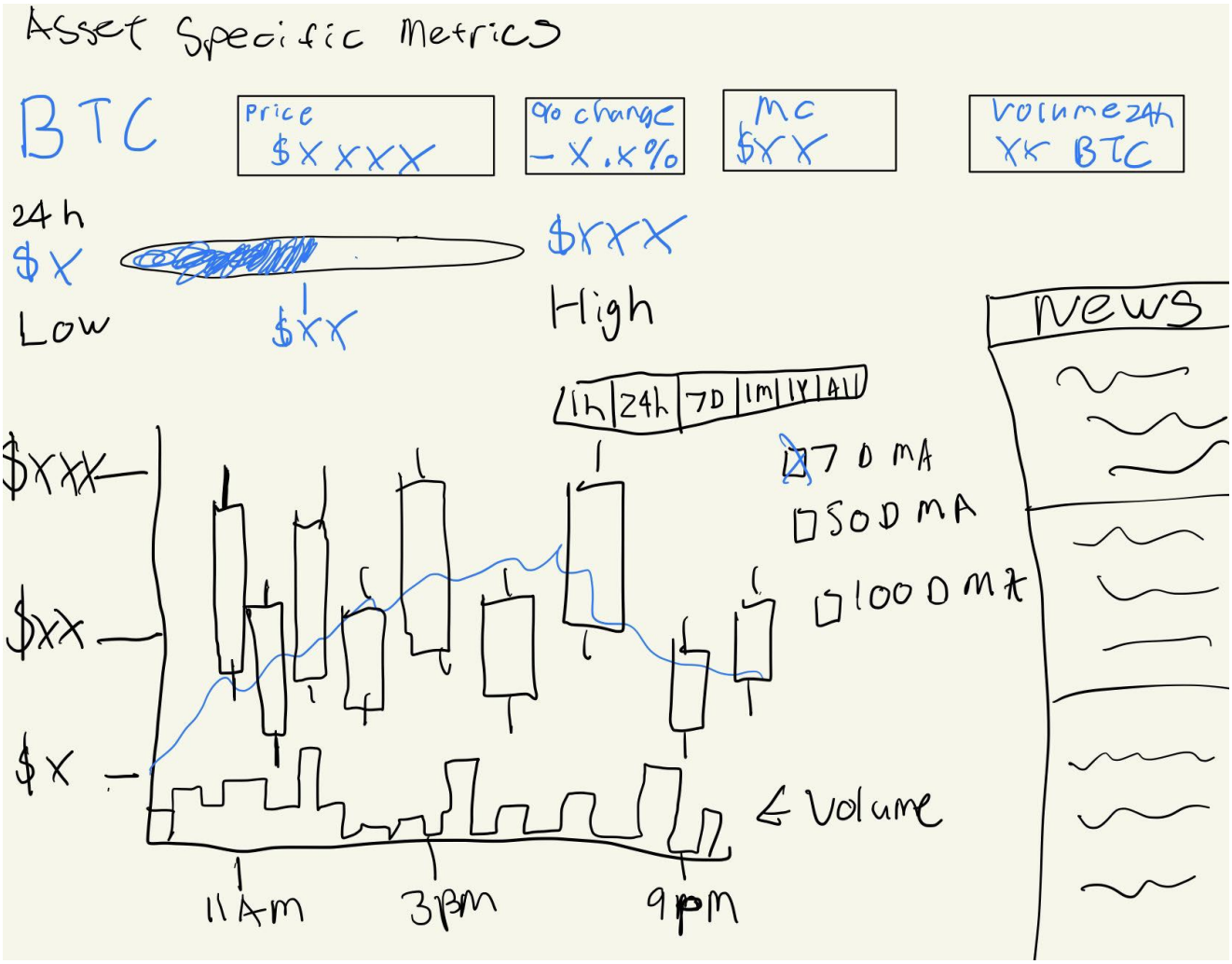
Nick Ryu

FAVORITE: With this dashboard page, I am hoping to provide the user with an overview of the entire cryptocurrency market as well as some metrics for the top performing assets. I chose to use a pie chart for the market cap breakdown as it is quickly digestible and familiar to almost everyone. I chose to use a table for the asset metrics because it is a clear way to show multiple traits for multiple assets. This would accomplish task 2 because it is giving people all the relevant data to learn basic financial analysis.



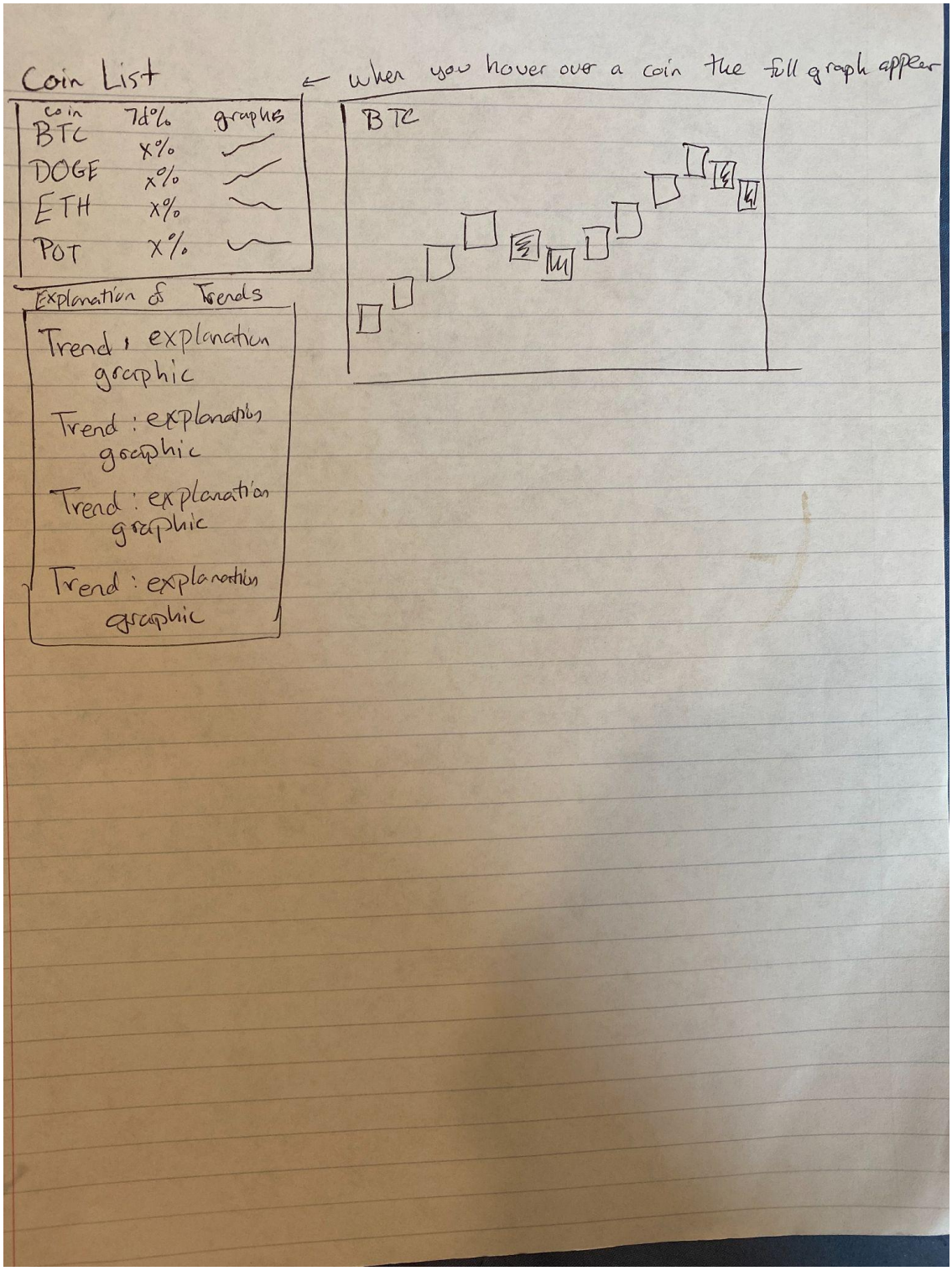
Nick Ryu

With this dashboard page, I am looking to give users a more in depth breakdown, by asset. This includes more metrics than the table in the dashboard sketch I drew above does. Similar to the reasoning for the table in my first dashboard sketch, I chose to use a table for the asset metrics because it is a clear way to show multiple traits for multiple assets. This would appear if a user clicked on the table in the first sketch. This accomplishes task 1 because if you hover over each metric, it would explain what it is and why it is important. It also accomplishes task 2 because it is teaching basic financial analysis.



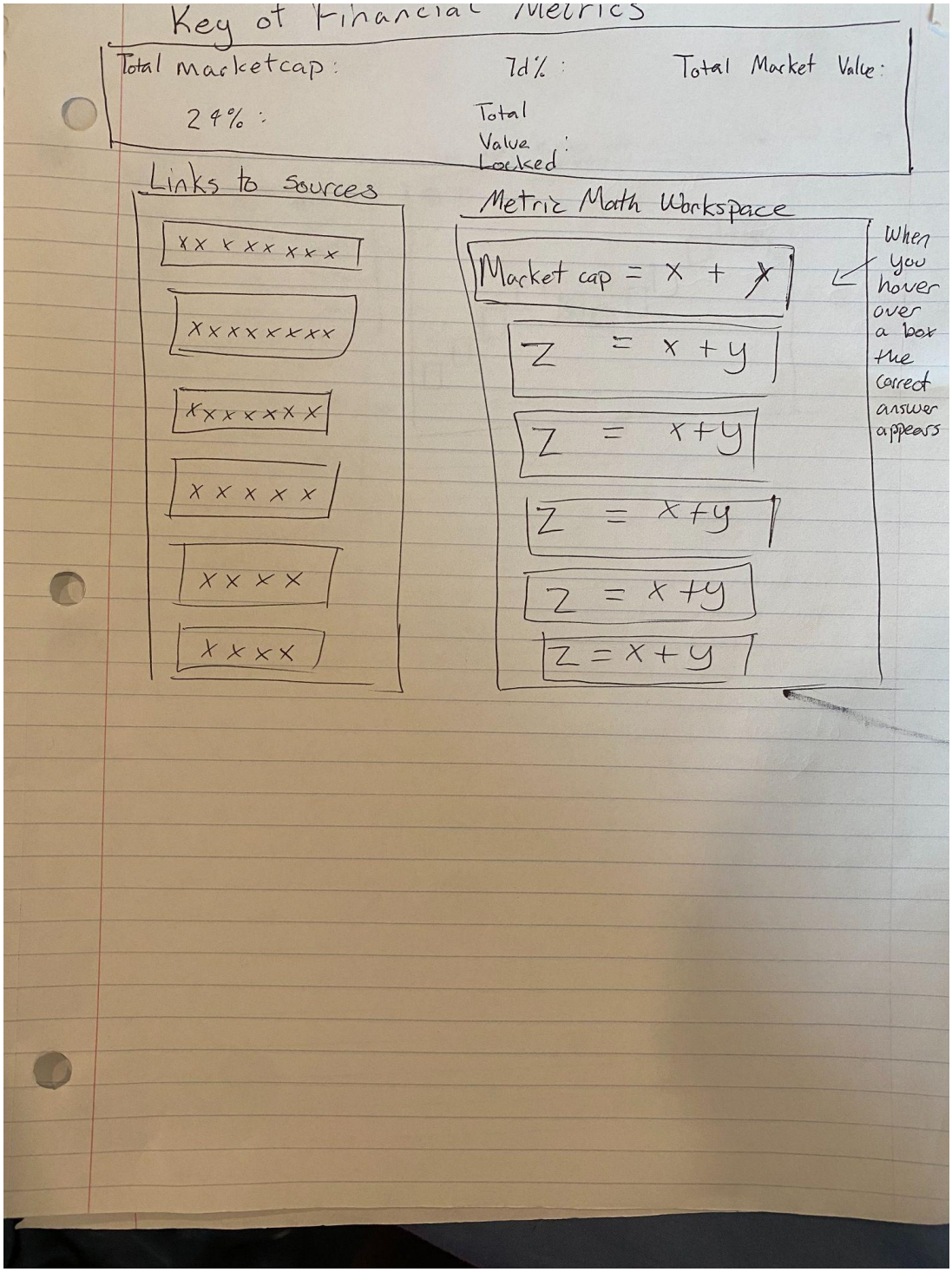
Nick Ryu

FAVORITE: With this dashboard page, I was hoping to give an in depth breakdown for a specific asset. This page would appear if the user clicked on any of the assets in the tables on either page. I chose to use the slide for the high and low prices because users can quickly tell what the high and low for the day were, as well as where the current price stands relative to them. I chose to use a candlestick chart to display current and historical data because it allows for users to quickly understand the trend of the price as well as being able to quickly switch between different timeframes. We are also able to add other indicators such as moving averages to teach them additional indicators. This accomplishes all 3 tasks we set out to accomplish with our tool. It accomplishes task 1 because similar to the other sketch, the user can hover over all the metrics and indicators to get an explanation of it. It accomplishes task 2 because it provides the data and indicators needed for financial analysis. Lastly, it accomplishes task 3 because it provides the user with the most recent news on the asset.



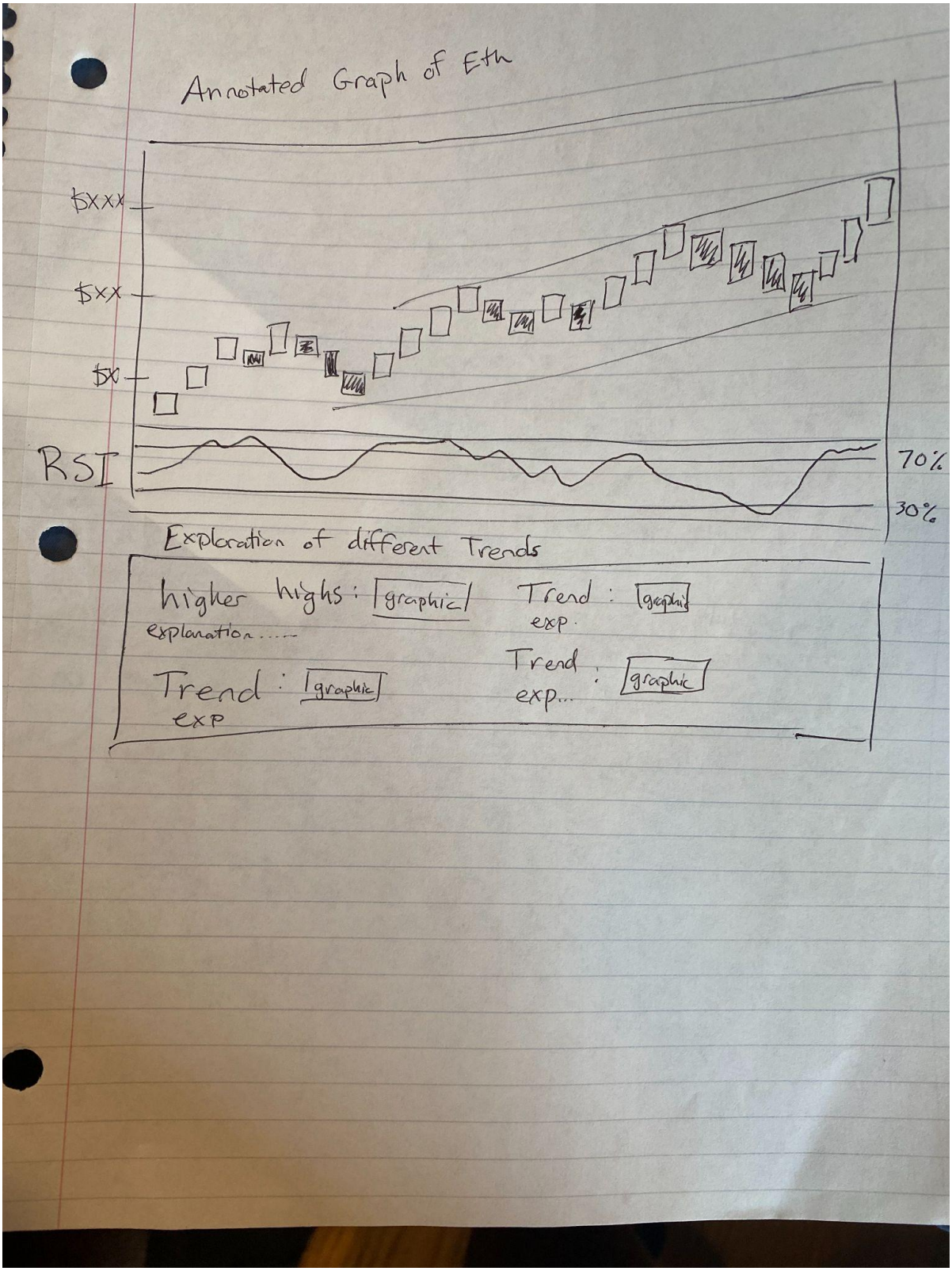
Wilson King

The main objective of this visualization is to teach our user basic predictive analysis. On the lower left side they will see different key statistics with explanations and mini visualizations of how they are used. When a user hovers over one of the coins on the top left side it will blow up the graph on the right side box. This will allow the user to use the skills they learned in the beginning to figure out different trends and practice deciding if a certain coin is a good or bad buy.



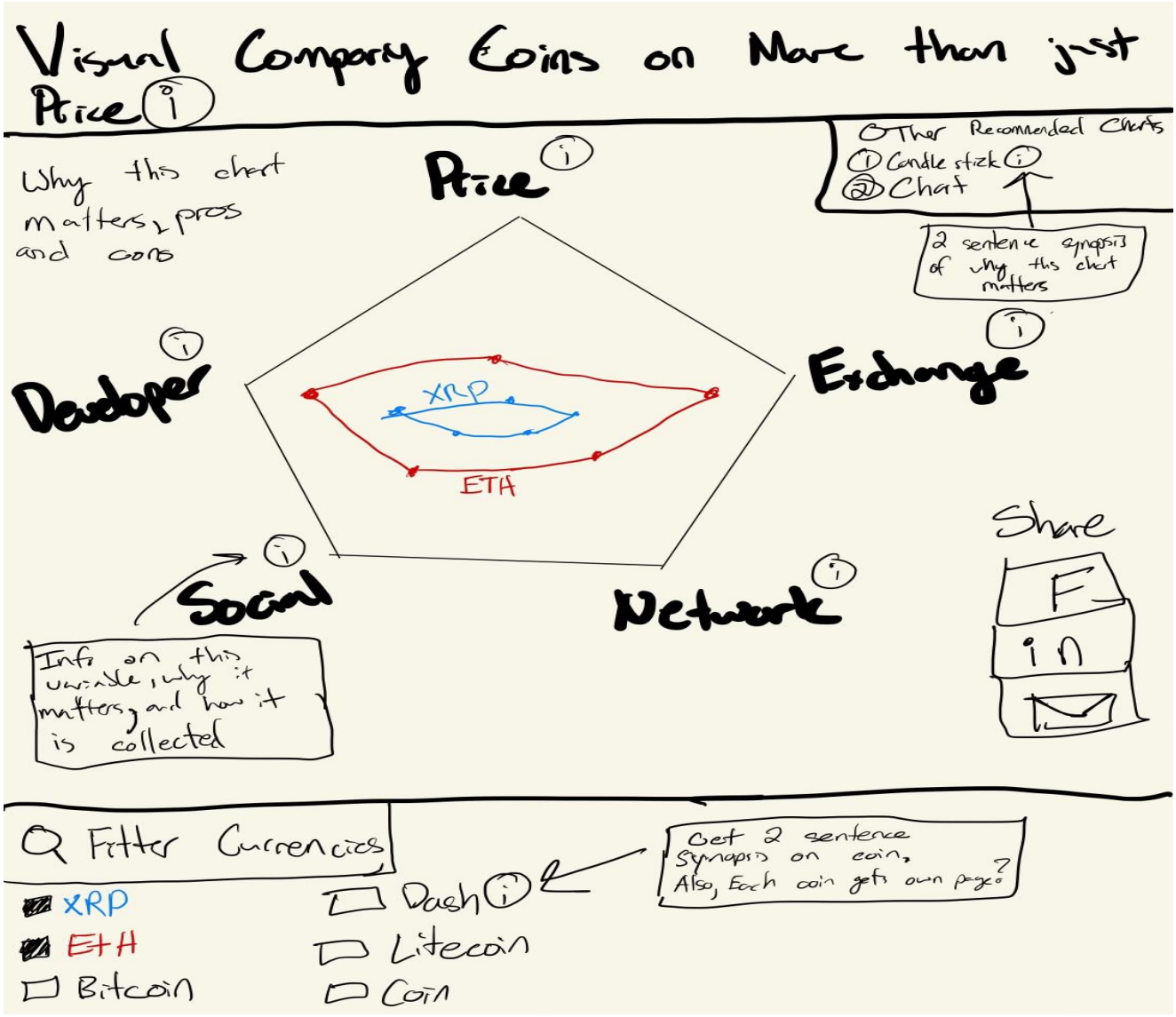
Wilson King

These visualizations will teach the user how to calculate different metrics. At the top will be a key of different metrics including explanations of what they mean and formulas for how to calculate them. On the bottom right will be different equations where only the final answer will be shown. Users will have the opportunity to try and figure out what goes in these equations based on the key above. When they would like to see the correct answer they can hover over the equation to see it. On the left side will be a list of reputable links and small examples of the type of information they offer.



Wilson King

This visualization will allow users to see how technical analysis is done. On top there will be a graph with an annotated candlestick chart. Each annotation will have a blurb attached signaling which it is when you hover over it. Underneath will be examples of all of these different trends to look for, including examples and graphics.

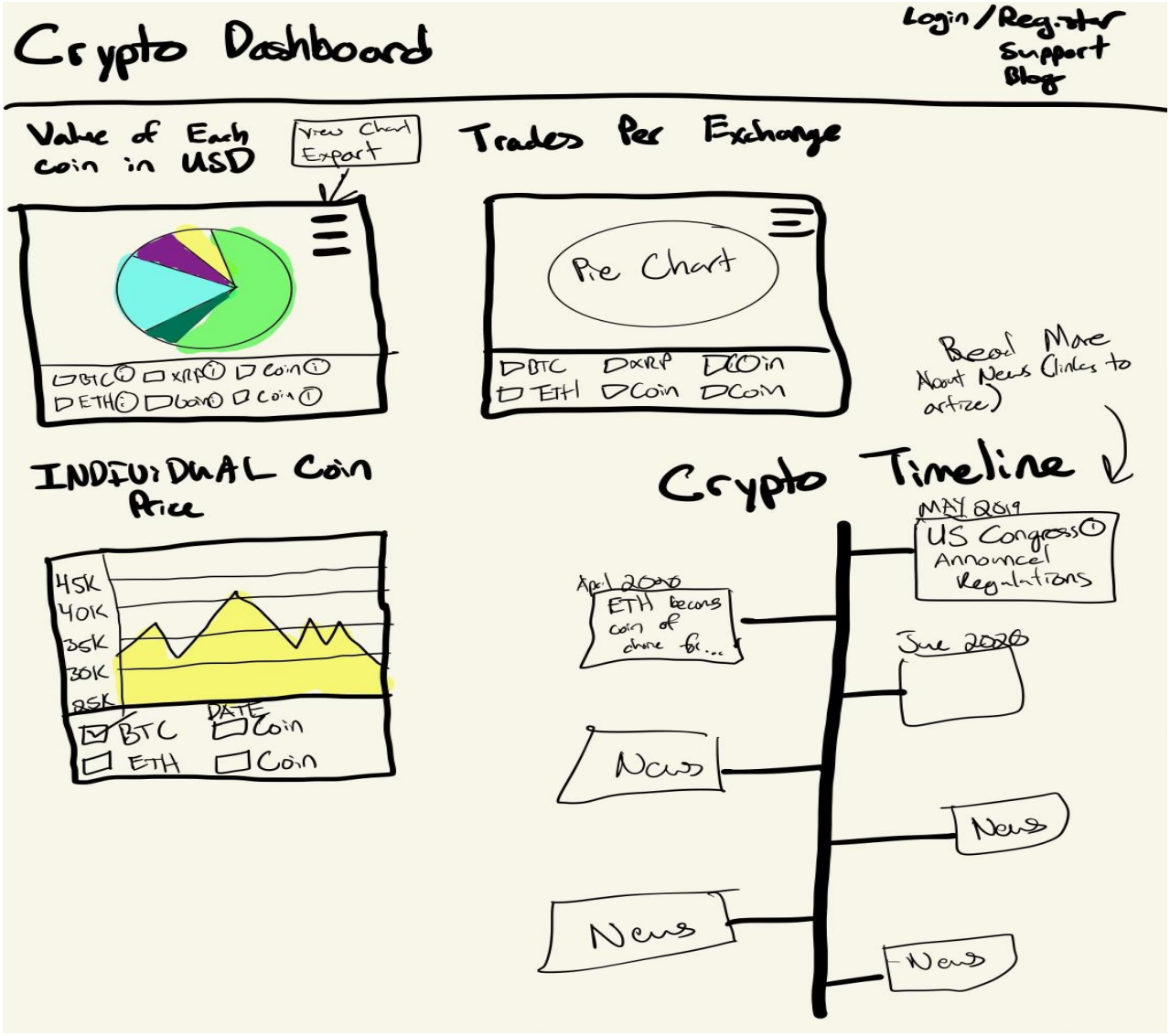


Evan Eddleston

This visualization accomplishes task 2 of our task table as it presents a visualization that shows how different factors effect a coin. I chose to use a radar chart to display how factors affect different coins. This allows the user to see how each coin behaves to different factors, and how the factors may influence the price of the coin. The chart also has the educational benefit of informing users that multiple factors may influence the price of a coin. The radar chart also allows coin to be compared to one another, which is an added benefit.

Evan Eddleston

This visualization accomplishes task 1 of our task table as it presents a visualization that shows different metrics across a variety of coins. I chose to use bar and table charts to display metrics across coins. This provides a high-level overview for users to see how a coin is interacting with the market. I thought to include the logos of the coins instead of the names in the first chart for more visual appeal, whereas the table below provides a more in-depth review of the coins if the user is interested in researching more.



Evan Eddleston

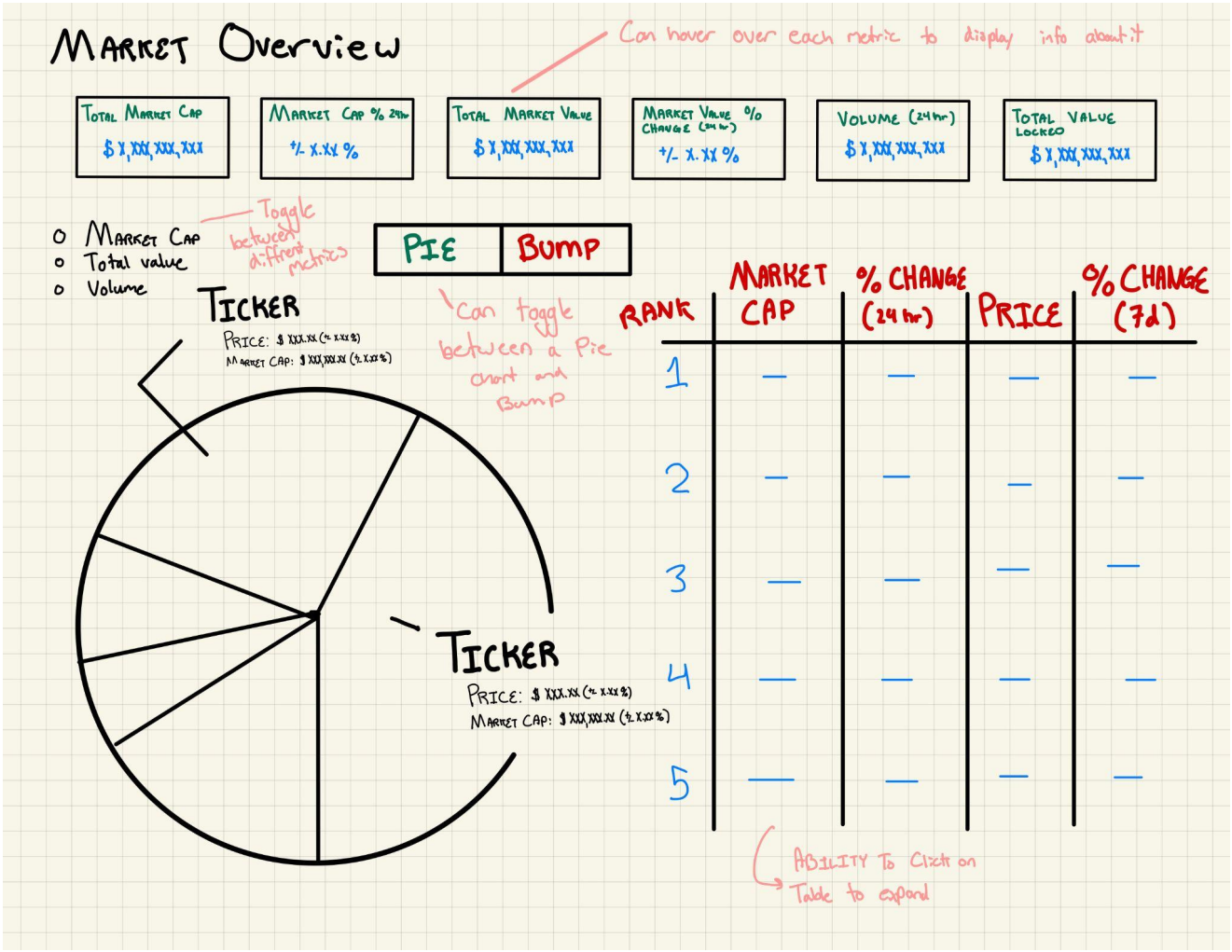
This visualization accomplishes task 1 and 3 of our task table as it presents a visualization that shows different metrics across a variety of coins and a timeline of recent news in the crypto world. I chose to use some pie charts and a line chart to display market metrics among coins. The pie charts compare coins to one another whereas the line chart compares a single coin to itself over a certain time period.. This provides a high-level overview for users to see how a coin is interacting with the market. The timeline provides users with a timeline of recent (and old) news in the crypto space. This will be valuable for beginner investors, so that they can see what news matters and the sources we trust to show them. It also provides a link to the news articles for users to read more about the current events.

Favorite Sketches

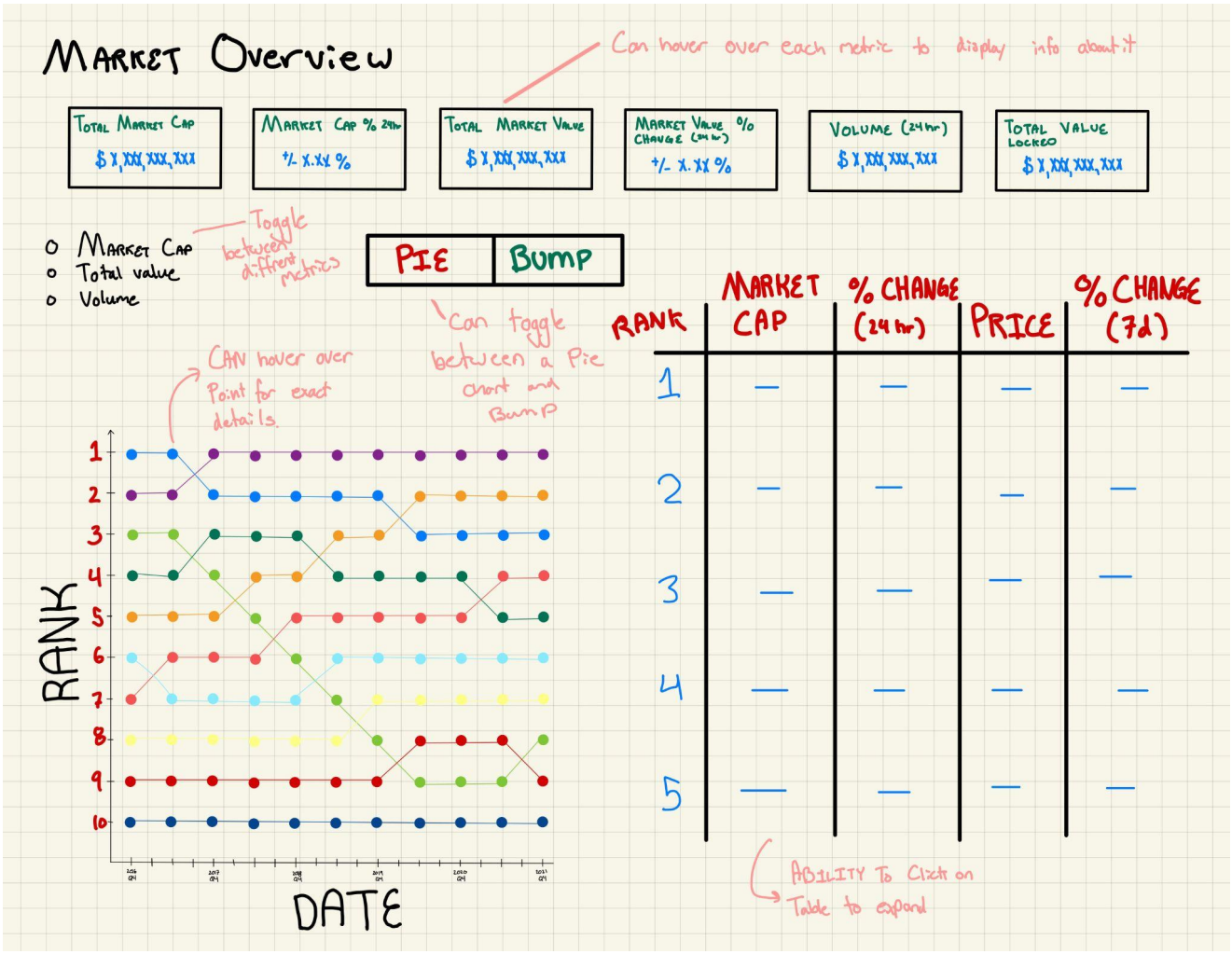
When choosing our team's favorite sketches, the most important criteria we tried to abide by was evaluating if the visualization accomplished one or more of our three tasks. To determine which of our sketches were the most proficient at accomplishing our tasks, we evaluated each sketch based on how well a user can digest the information, how much content is presented (both over and underwhelming), and lastly if the information displayed is relevant / actionable. Our group then met to go through each of our visualizations individually and gave it a ranking from 1-to 4 across the three criteria mentioned above. The three sketches that scored the highest were then selected as our favorites.

The first of our favorite sketches was the bump chart visualization created by group member John Treppo. This visualization effectively displays the variety of magnitudes present across the different cryptocurrencies. Magnitudes are often hard to analyze when using raw metric data because of the volatility across a given period. Therefore, ranking the coins with the bump chart avoided this issue, making the chart display digestible and actionable information that is complex but not overwhelming to a beginning investor. We believe this chart satisfied our objective from Task 1. Group member Nick Ryu created the second of our favorite sketches. This visualization effectively provides the user with an overview of the entire cryptocurrency market and some metrics for the top-performing assets. This visual accomplishes task 2 as it provides the most relevant data in a pie chart that is quickly digestible and pie charts a familiar visualization for people with and without a financial background. The last of our favorite visualizations were also created by group member Nick Ryu. This visualization provides a more in-depth analysis of an individual coin. This visualization includes a candlestick chart showing the high and low prices averages and predicting the future based on historical financial data. Although this visualization is more complex than any of the other visuals, we believe having an educational hover system will allow the user to teach themselves how to interpret the candlestick. On the right-hand side of the page, the dashboard will show recent news articles written about the coin / crypto market that may be useful to the user in learning about the coin. This visualization is unique in that it satisfies all three of our tasks while not being too dense with information. It accomplishes task 1 because the user can hover over the metrics to get an explanation of what the chart is analyzing. It accomplishes task 2 by providing the data and indicators needed for financial analysis. Lastly, it accomplishes task 3 because it provides the user with the most recent news on the asset.

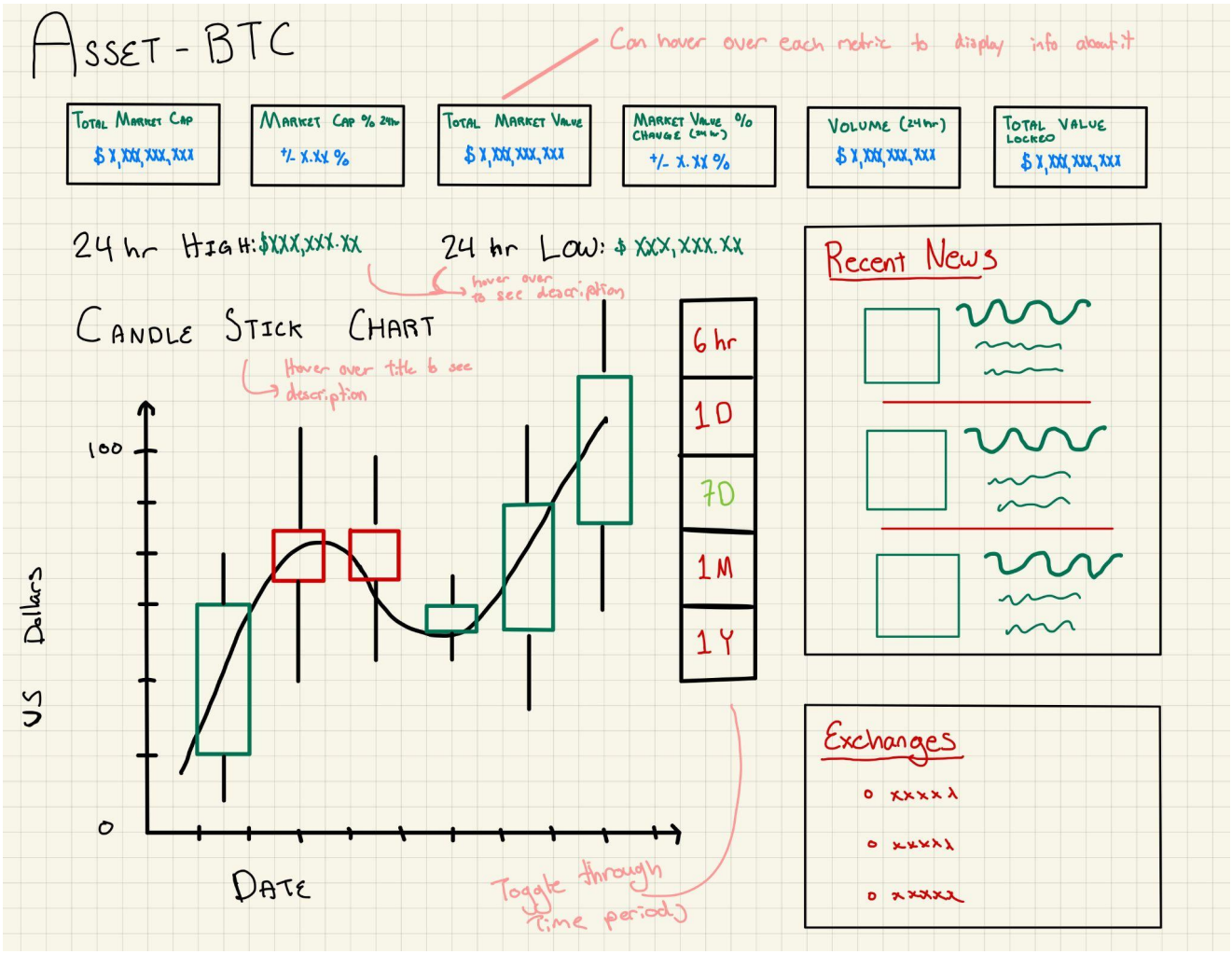
Entire Coordinated View Sketch



Pie chart view of our dashboard. Metrics on the market are displayed on the top of the view. On the right is a table which gives more context on the top running currencies. On the left is a pie chart of the desired statistic of the user's preference. The pie chart can be toggled to a bump chart by using the buttons to the top right of the pie chart.



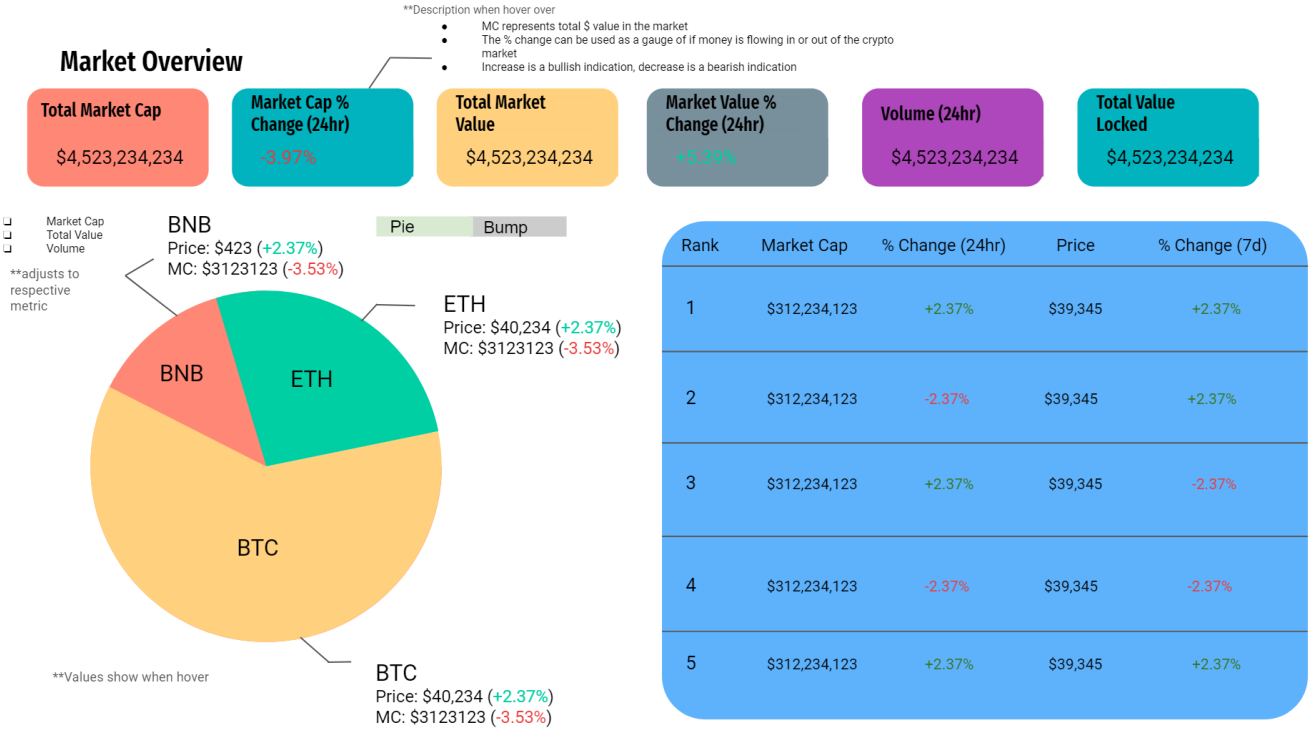
Bump Chart view of our dashboard. Metrics on the market are displayed on the top of the view. On the right is a table which gives more context on the top running currencies. On the left is a bump chart of the desired statistic of the user's preference. The bump chart can be toggled to a pie chart by using the buttons to the top right of the pie chart.



Currency deep dive view of our dashboard. Metrics of the specific currency are displayed on the top of the view. On The left is a Candlestick Chart giving a deeper insight into the currencies performance. On the right are recent news articles about the currency and the exchanges the currency currently is traded on.

With readability and understanding being our top priority we chose encodings which will allow the visualization to be used as a first step for our users. We knew that we wanted the metrics being displayed on the top of every view so they could be easily found. The user will have the ability to hover over them to display a pop up that would explain the metrics and give resources to further a user's knowledge. We know that the magnitudes of different metrics can cause cryptocurrency visualizations to be skewed so we wanted to offer different approaches. The first is a pie chart which can be used to visualize the difference in magnitudes, however the smaller currencies would be lost. This is why we want the ability to toggle to a bump chart. A bump chart will rank currencies based on a metric so smaller currencies will have the same visual weight. The final visualization in our dashboard will be a table. The table will give the raw numbers which can be used to compare the different metrics of the currencies. Through clicking on a row of the table a user will be directed to an additional currency specific view. This will allow the user to gain a better understanding of one particular currency. We decided to utilize a candlestick chart because it can give insight to the trends of a currency over a given time period. Additionally, the external factors surrounding a currency have a huge impact on its performance. By displaying the most recent news surrounding a currency can give additional context to the currency. Finally, the exchanges which the currency is offered are displayed, so a user has the ability to easily identify how to trade the currency.

Appendix E: Digital Sketch



Rank	Market Cap	% Change (24hr)	Price	% Change (7d)
1	$312,234,123	+2.37%	$39,345	+2.37%
2	$312,234,123	-2.37%	$39,345	+2.37%
3	$312,234,123	+2.37%	$39,345	-2.37%
4	$312,234,123	-2.37%	$39,345	-2.37%
5	$312,234,123	+2.37%	$39,345	+2.37%

Market Overview

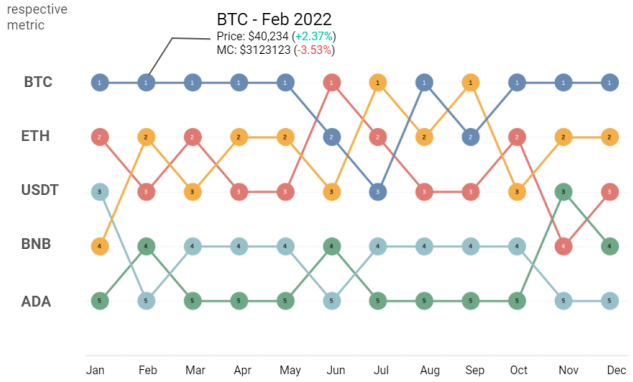
**Description when hover over
- MC represents total $ value in the market
- The % change can be used as a gauge of if money is flowing in or out of the crypto market
- Increase is a bullish indication, decrease is a bearish indication

Total Market Cap	Market Cap % Change (24hr)	Total Market Value	Market Value % Change (24hr)	Volume (24hr)	Total Value Locked
$4,523,234,234	-3.97%	$4,523,234,234	+5.39%	$4,523,234,234	$4,523,234,234

Market Cap
Total Value
Volume

**adjusts to respective metric

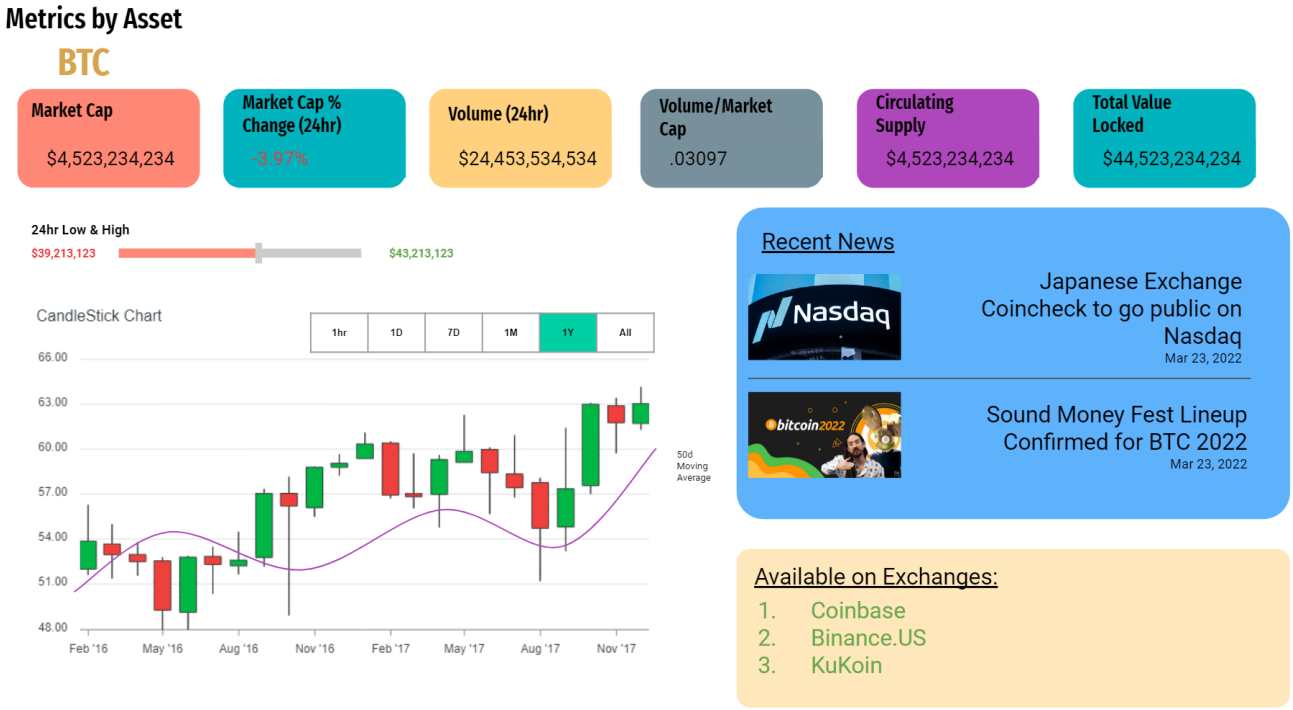
Pie | Bump



Rank	Market Cap	% Change (24hr)	Price	% Change (7d)
1	$312,234,123	+2.37%	$39,345	+2.37%
2	$312,234,123	-2.37%	$39,345	+2.37%
3	$312,234,123	+2.37%	$39,345	-2.37%
4	$312,234,123	-2.37%	$39,345	-2.37%
5	$312,234,123	+2.37%	$39,345	+2.37%

Metrics for All Assets

Rank	Ticker	Name	Price	24hr%	7d%	Market Cap	24hr%	7d%	Volume 24hr	Circulating Supply	TVL	Dominance	Total Supply	Max Supply
1	BTC	Bitcoin	$40,223	+3.45%	+3.05%	$320,234,132	3.45%	-3.05%	$345,234 21,345 BTC	18,823,345 BTC	$129,234,123	41.9%	15,000,000 BTC	21,000,000 BTC
2	ETH	Ethereum	$40,223	+3.45%	+3.05%	$320,234,132	3.45%	-3.05%	$345,234 21,345 ETH	18,823,345 BTC	$129,234,123	41.9%	15,000,000 ETH	21,000,000 ETH
3	USDT	Tether	$40,223	+3.45%	+3.05%	$320,234,132	3.45%	-3.05%	$345,234 21,345 USDT	18,823,345 BTC	$129,234,123	41.9%	15,000,000 USDT	21,000,000 USDT
4	BNB	Binance Coin	$40,223	+3.45%	+3.05%	$320,234,132	3.45%	-3.05%	$345,234 21,345 BNB	18,823,345 BTC	$129,234,123	41.9%	15,000,000 BNB	21,000,000 BNB
5	ADA	Cardano	$40,223	+3.45%	+3.05%	$320,234,132	3.45%	-3.05%	$345,234 21,345 ADA	18,823,345 BTC	$129,234,123	41.9%	15,000,000 ADA	21,000,000 ADA



We envision our user will initially open the dashboard and land on a page of the first sketch. There they will be able to see the overall trends and state of the market as they will be provided relevant metrics such as market cap, percent change, volume, and total value locked which will also be summarized into a pie and bump chart. In the case that they are unaware of some of these metrics, they can hover over any of them to get a description of what it is, and why it is important. This fulfills our first domain task of showing important metrics as well as conveying why those metrics are important. Additionally, a user will be able to hover over a slice of the pie or a point in the bump chart to get the exact details as well as link to the table. The metric being used in the pie or bump charts column will be highlighted so the user can have additional context. Once the user gets a general idea of the state of the market, the user can then click on the table to expand it. Once they expand it, they will be able to see additional metrics, by asset, for all of the assets available. By providing the user with all the data for the respective assets, tied with our educational descriptions, we will be able to accomplish our second domain task of teaching basic financial analysis as users will be able to compare the assets and utilize those metrics we taught them. Once they have one or two assets they are interested in and want to learn more about, they can click on any of the individual cryptocurrencies to be brought to an asset specific page. Here they would be able to see metrics relevant to the respective asset as well as having a candlestick chart where users can view the historical financial data and conduct financial analysis on different time frames. The page also has recent news articles which completes our third domain task of providing the user with up to date reputable news sources. We envision them utilizing the news articles to help them take a position at the best time. Once the user is up to date and has conducted their financial analysis, we link pages to exchanges where they can purchase the asset and take a position depending on what their analysis concluded.

Appendix F: Usability Testing

Preparation + Answers

Hello everyone, thank you for taking the time to test our data visualization project. My name is Evan, and alongside me are my teammates Nick, Wilson, and John. Feel free to ask questions along the way, and any question is a good one! To give a brief overview of our project, we are building an educational dashboard for early investors who want to learn more about the crypto market. Our visualizations are targeted at people with a little financial background, with the goal being to deliver actionable and digestible information. The data you see on the dashboard is pulled from a crypto API that has the most relevant market data on the top 24 crypto coins (e.g., Bitcoin, Ethereum, XRP, etc.). For the purpose of this visualization, it should be noted that the dashboard is currently using data pulled from a CSV a few weeks prior, so the data seen here is out of date and should only be used for usability testing purposes only. Also, if we are not conducting the usability testing in-person together, we ask if you could record your screen and share it with us after all the tasks are complete. This will help us in understanding where you tried to interact with the visualizations using your mouse.

Task 1: Take a **look at the market overview tabs and summarize** what is going on in the market today. We would like to test to see if our users can digest market data based on these five tabs and summarize how the market as a whole is behaving. Since some of these terms, such as "Total Volume Locked," will likely be unfamiliar to them, we want to see if they hover their mouse over the tabs to see the definitions appear. Furthermore, we want to see if they click on the hyperlink at the bottom of the pop-up to learn more about the definitions. We will also see if any of these metrics resonate more or less with the users because we could always remove, shuffle the order, or add more market overview tabs if needed. Lastly, we will ask if our definitions make sense to them.

Task 2: Take a moment to view the pie chart. As of right now, the smaller coins on the pie chart are not readable. **Tell us what coins make up the majority of the crypto market**. Furthermore, identify if the users care about many of the smaller coins that make up only a tiny portion of the crypto market compared to coins like bitcoin. Additionally, see how their mouse interacts with the pie chart. Currently, we don't have any interactions with the pie chart, so seeing how the user's mouse behaves will perhaps give us some guidance on key features to include. We will also ask the user what features to include to make the pie chart easier to digest.

Task 3: View the bump chart (visualization under the pie chart) and **tell us which currencies have had the greatest increase in price.** We are looking to see how users look to identify the various currencies. Currently, we have a hover mechanism that displays the currency and price when the mouse is on one of the "bubbles". Additionally, a user can click on a currencies line to highlight it. This interaction does not occur when the mouse hovers over the lines connecting the bubbles in the bump chart. We also want to ask them if we should include a legend for users to identify the different currencies more easily.

Task 4 (optional): View the candlestick chart and **tell us what you believe it is visualizing**. Our candlestick chart is still in its early stages, so our usability testing has not made it a required task. However, it would still be beneficial to see how users interact with the chart and what conclusions they think they can draw. This will help us understand what features in the chart we need to educate users on and if we need to add definitions for each feature or just one definition for the candlestick chart.

Results

To summarize the test results, we found learned something valuable from each of the four tasks we had the users complete. The users we tested our visualization with did not know much about financial models or terminology, which made it apparent that our visualization explanations needed to be in far more detail. The users understood the market overview and pie chart visualizations but struggled to answer the questions that pertained to the bump chart and candlestick visualizations. The major issue we identified through the user testing was that they struggled to interpret the bump and candlestick charts because they didn't have a key or overview of what the chart was analyzing and the various features. The users understood the market overview because we included interactive pop-ups that defined each metric. The users already understood the pie chart because of past experiences using it. Therefore, we will include more definitions for the bump and candlestick charts, emphasizing how to analyze the charts rather than explaining the actionable information drawn from the charts. We identified a minor issue with the lack of an interactive feature on the pie chart. The users suggested we include a pop-up interaction that provides a synopsis of each coin. The users also pointed out that two of our market overview definition links are invalid, so we need to fix those. Overall, the users thought the visualizations looked developed and could correctly interpret the charts with ample explanation. However, the charts that were more complicated and unfamiliar to the users were not able to be interpreted.

Task 1: The users took 2-minutes to collect their thoughts and then provided a concise synopsis of an overview of how the market was behaving. The users successfully hovered over each tab to display the interactive explanation of each value. All but 1 of the users understood the metrics total market cap, market cap change %, market value change %, and Volume (24hr). However, even after reading the definitions, the users did not completely grasp total value locked. They, therefore, clicked on the linked article to learn more about the financial metric. Overall, this was successfully executed, and no major change will be needed to the visualization.

Task 2: The users correctly answered that the coin BTC makes up almost 50% of the market and ETH makes up another 20.7%. The users who were not familiar with cryptocurrencies wanted to see the smaller (less market share) coins; however, many of the coin names overlapped with one another with the current state of our visualization. Our team will need to decide to either reduce the number of coins displayed or update the visualization to show the coins better. The users also tried to interact with the pie chart, which currently doesn't have any interactions. When asked what they expected for an interaction, most of the users asked for an explanation. They highly recommend adding additional information about what the pie chart is analyzing. Overall, the users completed the task, but issues with the pie chart were identified. We have already made some changes to the pie based on the outcome of this task.

Task 3: The users incorrectly answered the task's question on which coins had the highest and lowest increase in price. They believed DOGE had the highest price increase when it was the coin SOL in reality. The users assumed the ranks when from lowest to highest (ascending order) when in reality, the ranks were in descending order. In our next push, we will be sure to include in that the chart prices are ranked in descending order. The user also asked for a minor change to the interactive feature of the bump chart. Currently, we display coin information if a user's mouse hovers over one of the nodes on the bump chart, but initially, the user tried to see if there was an interaction by hovering over the line. This is a small design change we plan to make in the future. They also asked for a legend so they could see what coin was represented by each line on the chart. This feedback was greatly appreciated, and design changes will be made.

Task 4: Given that the candlestick chart was not in its final stage, the users severely struggled to interpret the chart. Even after explaining the various features to them and how to analyze the candlestick, they told us it was too overwhelming. Given that this chart is one of the more challenging financial visualizations to interpret, we were not surprised by their answer. We confirmed that a more in-depth description of the visualization would be needed.

We will be updating our visualization based on the feedback collected from the usability tests. Much of the modifications that will be pushed have been mentioned in the above paragraphs. We will update the two invalid links that our users discovered for the market overview tabs. For the pie chart, we added two interactions.The first interaction highlights the coin in the table when a user hovers over a certain pie chart slice. The other interaction enlarges the pie chart slice that a user's mouse is on. Both of these changes were done to allow the user to analyze the coins with less market share than some of the bigger coins. We plan to make future updates based on the usability test for the bump chart, but had to prioritize our resources to the candlestick chart, which needed far more work. However, we were able to improve the x-axis labels for better readability. For the candlestick chart, we significantly updated the usability and filtering options. Now the user can switch between coins to view each coin's individual performance weekly instead of daily. However, these modifications forced

an error causing the chart not to display properly. Perhaps the most important improvement we made to the crypto dashboard was the added descriptions for each visualization. This provides users with the tools necessary to better understand the financial figures.