What Makes a Popular Board Game?

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Summary of Research Questions:

a) *Which factor(s) correlates to a higher BGG rating?*

We found that "average playing time" and "recommended age" are the two major factors that affect a board game's official "BoardGameGeek" (BGG) rating. For reference, extremely short or long board games, as well as younger target ages tend to result in lower ratings.

b) *What makes a successful board game?*

Assuming that success is rooted in the number of owners of a board game, rather than its BGG ranking, we believe that successful games are typically linked to the year that they were released in. Titles released from 2000 to 2018 seemed to have the most owners, possibly unlocking trends within the board game industry.

c) *How well does BGG ranking correlate to average popularity?*

The BGG ranking offers a good starting point for determining if a board game is relatively popular or not, but there are several outlying games that are ranked significantly lower, yet have a high number of owners.

d) *How well can we predict a board game's BGG rating based on its game statistics?*

Our training model was able to predict the BGG rating of an example board game with only a mean squared error of 0.422, indicating a near-perfect prediction.

Motivation:

Our motivation for working with board game data came from our curiosity regarding the topic set, as well as our knowledge of today's digital society. As more things are becoming computerized and virtual, it is important to consider whether physical forms of entertainment, specifically board games, are still popular enough to be produced. In the situation where they are not relevant anymore, manufacturing companies should consider reallocating their resources to other places in order to accommodate the actual needs of today's world. Given that board games are, most of the time, created in factories, it is necessary to take note if they have lost popularity because large amounts of pollution could be avoided with the possible termination of board game manufacture.

Dataset:

The datasets that we will be working with various aspects of board games that are being produced today, including names, recommended player counts, average customer reviews, and official "Board Game Geek (BGG)" rankings. Linked below are the following datasets that we will be considering in our report:

- https://www.kaggle.com/datasets/andrewmvd/board-games
- https://www.kaggle.com/datasets/mrpantherson/board-game-data

Method:

Our first step before conducting any data analysis is to gather and examine the datasets from Kaggle using the links that are provided in the earlier parts of this document. Upon completion of that, we should be ready to tackle the problems posed by our research questions.

Considering the first research question, we will primarily focus on the columns regarding the board game's average play times and its recommended ages. By using these two aspects, we will compile some form of visualization chart that displays the connection between two variables and its board game rating. After creating the chart, we will examine it to see if there is a correlation between the two variables using trends we notice. If there are not any parallels in the chart, then we can conclude that there is not a noticeable correlation between the board game's player count and its rating.

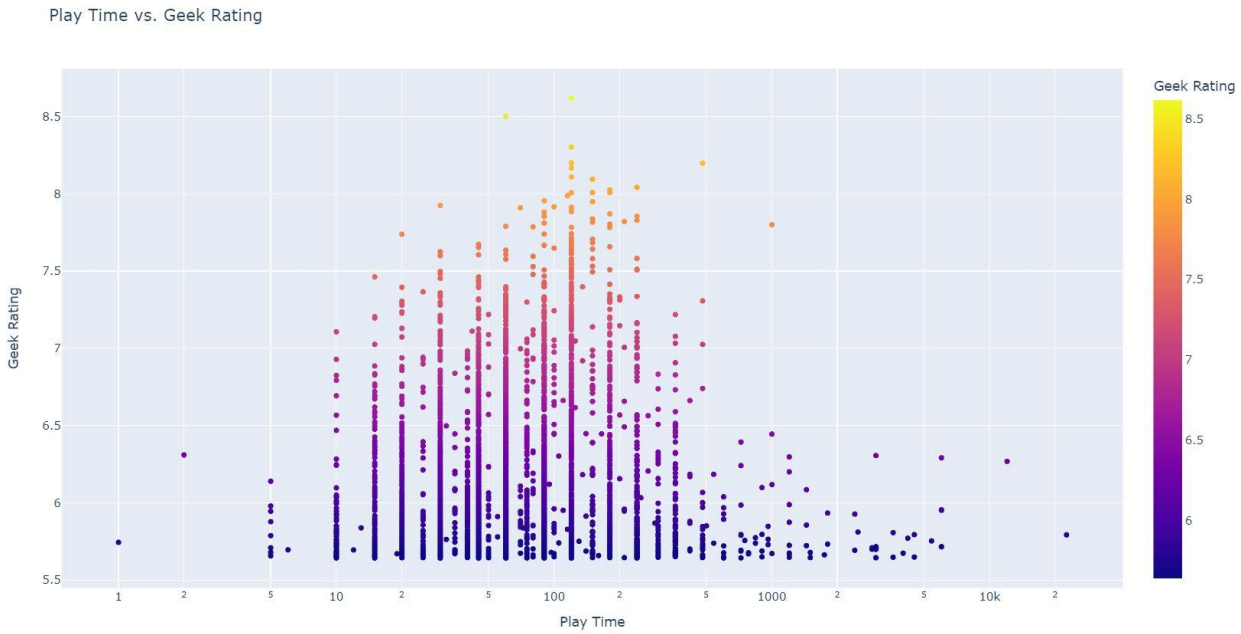
Moving onto the next questions, we will approach them with a fairly similar approach as the last question, except that we will be considering different columns instead. The main value we will be focusing on is the board game's number of owners. First, we will develop some form of a visualization chart and examine it to see if there exists a relationship between the number of owners versus any other variables we choose to analyze. After looking at the chart, we can make our conclusions and deliver a response to our posed research question. We will also consider how the amount of owners correlates with a board game's BGG ranking to see if there is a strong relationship there.

After answering the first three research questions, we can then answer the fourth research question, how well can we predict a board game's BGG rating? We would do this by creating some sort of learning model that would take in several example board games and try to find trends within their features in order to predict the rating of a never before seen game.

Results:

After combining the values of two different datasets, as well as straining out certain features to focus on specific problems at hand, we were able to figure out which factors produce

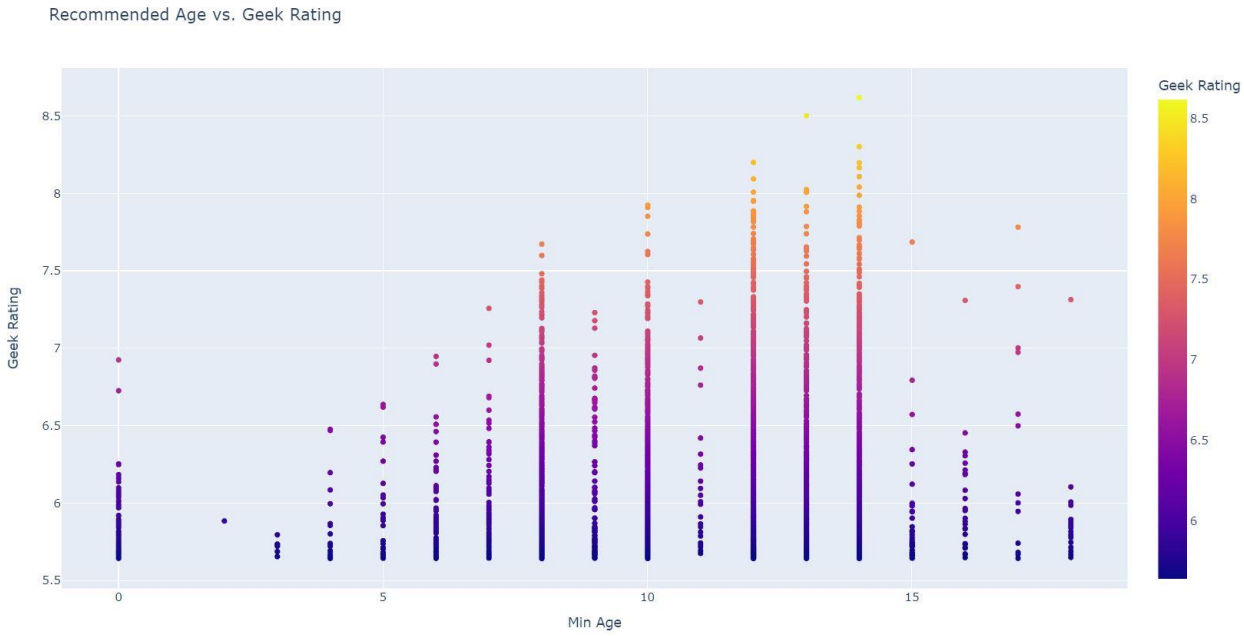
a successful board game and gain a better understanding of how much the official "BoardGameGeek" rating correlates with this conclusion. When focusing on which factors generate a higher BGG rating, we concluded that average playing times and recommended player counts are the two most important ones (A.1). We learned that board games that scored higher ratings were typically in the 30 to 180 minute range, with the peak being at 120 minutes. Games that take shorter than 90 minutes, though, still had certain titles that produced higher scores, it is just that a majority of higher scores can be found within the 90 to 180 minute range. Knowing this information can help improve the board game selections of companies as they are able to focus on manufacturing games that fall within the sweet spot. One major consequence of this, though, would be the disappearance of variety. If all companies pushed for this agenda, then all games would take close to two hours to complete and shorter board games would be less common. Providing a vast assortment of titles should still be of main interest to board game companies, though, as it can drive the economy and provide competition, but if they really want to help improve their BGG ratings, they should try to keep within a certain playtime range for their games.



A.1: This visualization chart is a scatter plot and compares the recommended playing time of board games to the BGG rating it was given. “Play Time” is used for the x-axis, while “Geek Rating” is used for the y-axis. The color gradient goes from a deep blue to bright yellow as the scores go up. As depicted in the plot, an almost-perfect bell curve is displayed, with the peak being at 120 minutes.

In terms of recommended ages, we found that a similar phenomenon occurs as a skewed left chart is displayed, with the peak being at 14 years old (A.2). As games that require an older age progress, so do the ratings, but upon reaching the peak, scores rapidly decrease. Knowing that the BGG takes complexity and game mechanics into consideration when computing their ratings, it makes sense for games that recommend 14 year olds to have higher scores since they are old enough that they can understand more complex rules, but still young enough to exhibit an interest in playing board games. Games that recommend younger ages are limited in their complexity factors because they have to create games that cater to . In these cases, companies might choose to utilize colorful elements in their games’ designs or implement more

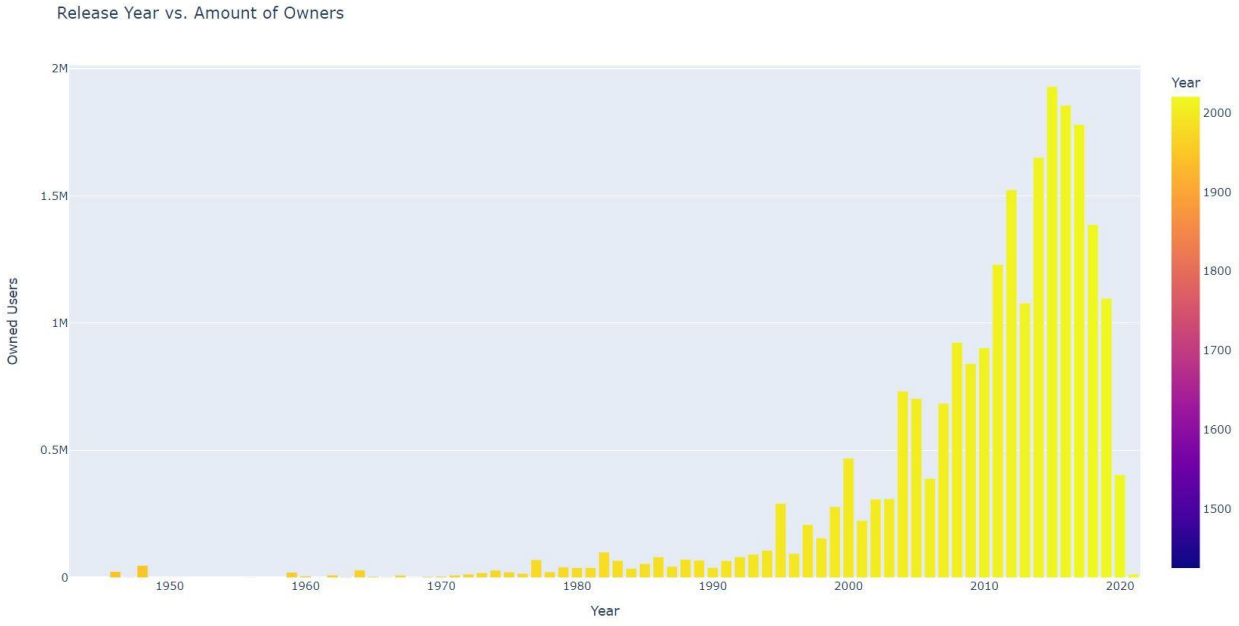
comprehensible rules to draw in larger audiences. These decisions may not lead to higher ratings, but they will at least garner a good following.



A.2: This visualization chart is also a scatter plot that compares the recommended ages of board games to the BGG rating it was given. “Minimum Age” is used for the x-axis, while “Geek Rating” is used for the y-axis. Same as the last plot, the color gradient goes from a deep blue to bright yellow as the scores go up. As seen in the trends, scores climb up as the ages progress, but reach a peak at 14 years old and then decline afterwards.

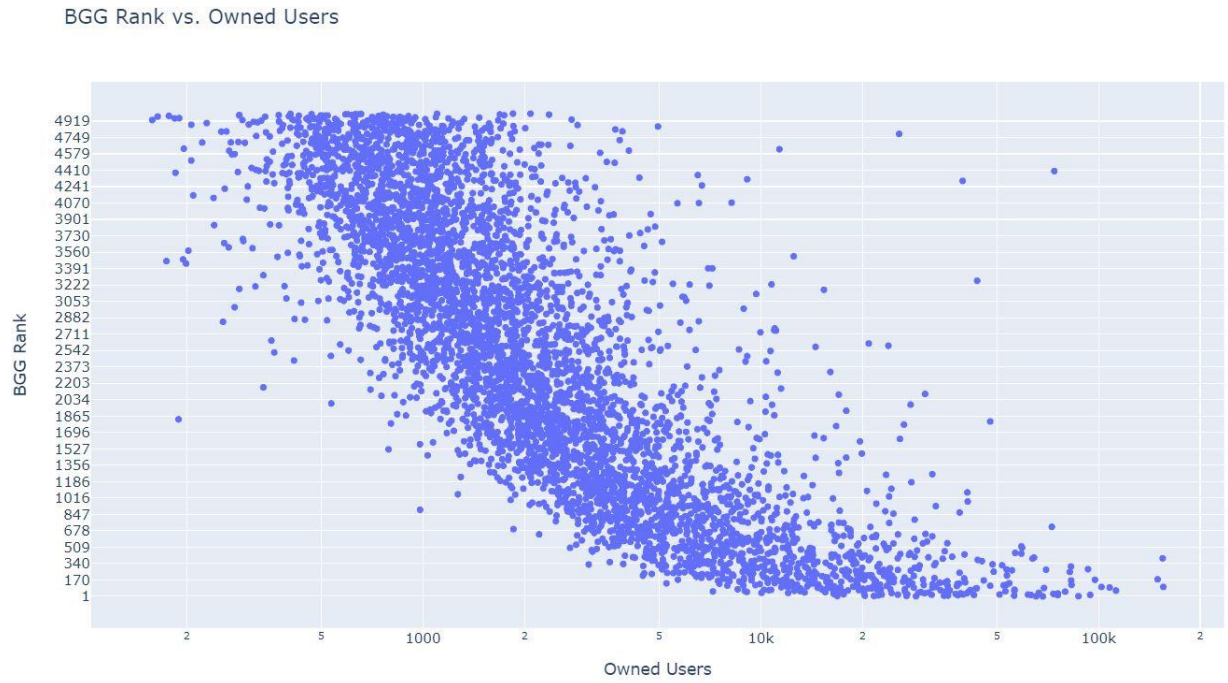
Moving onto the popularity aspect of board games, we wanted to analyze two separate relationships: which factors create a successful board game and how much does the BGG ranking correlate with popularity. In the first case, we decided to base success on the amount of owners that a board game has, rather than its BGG ranking or rating. If a game had a large quantity of players, then we considered it to be successful since it is popular, rather than considering whether it earned high scores or not. We chose to look at the sum of board game owners per year and found that board games released in the 21st century have had an overall good run compared to titles released in the previous century (A.3). There is an exception, though,

which is that games that have been released after 2019 have slightly declined in number of owners, possibly due to the increase in online alternatives or because this dataset is not completely up-to-date and disregards any other titles that were released in the latter parts of 2021 and beyond. With this in mind, we still concluded that release year is important in determining whether a game is successful or not because we believe that certain factors throughout the years have affected the board game economy, such as the development of technology. With board games on a decline in popularity, it might be best to shift towards alternative ways of marketing the elements of board games in another form, such as an online version or application that can be downloaded. These changes may decrease the amount of pollution that factories put out when manufacturing these items which can heavily benefit today's environment.



A.3: This visualization chart is a bar chart that plots the amount of board game owners per year from the first year in our dataset, up to 2021. The color gradient visualizes each year, with the amount of owners being displayed on the y-axis and year on the x-axis.

Continuing to follow the popularity trends of board games, we wanted to further analyze whether or not BGG rankings actually consider if a board game has a large following or not. We found that certain games actually have greater audiences than games that are ranked higher than them (A.4). For context, the number one board game, *Gloomhaven*, has about sixty-eight thousand owners, but there are several other titles that are ranked way lower that have broader owner populations. There is a visual relationship between the two variables, though, as seen in the trends displayed by the scatter plot, but one should not base the BGG rank as the major component when considering whether a board game is popular or not. There are several outlying games that are more popular than Gloomhaven that are not as recognized as it. Timeless family favorites, like *Monopoly* and *Game of Life*, were robbed of their rankings by placing 22,528 and 22,530, respectively, by the official BGG ranking team.



A.4: This visualization chart is a scatter plot that displays each board game according to the BGG rank it earned compared to how many owners it has. The amount of owners are placed on the x-axis and the BGG rank is on the y-axis.

Lastly, we wanted to implement a training model that can predict the BGG rating of an example board game, given certain characteristics. Our results gave us a mean squared error of only 0.422, meaning that our model is fairly accurate. We were able to harvest a “close-to-zero” mean squared error score from running a single example board game. In order to keep on verifying the overall validity of our model, though, we would probably run more board games into our model to increase its accuracy and venture closer to a score of zero. Based on our initial results, though, it is already fairly accurate and should be able to closely predict the BGG ratings of other games.

Impact and Limitations:

As previously stated in this report, technology is rapidly being integrated into almost all parts of our lives, from replacing human workers in factories, to helping us perform simple daily tasks, like automatically turning off the lights. From this data analysis, we learn that board games of recent years are less popular than ones from decades ago. Given these results, one major group that will be harmed by these implications are companies that produce board games, such as Hasbro, Mattel, and Asmodee Editions. While physical copies are not as popular anymore, completely cutting off the manufacturing of them will separate these companies from a potential area of profit. These companies would have to find ways to adapt to the advancing technological society we live in today in order to make up for their possible losses by programming their table-top games to have an online option. One major group that will indirectly benefit from these results are every other human in the world. By lowering or even putting a complete halt on board game production, less factory work will be dedicated to that causing a decrease in pollutants released. Less population will eventually put a less strain on our ever-faltering environment.

Considering the possible biases that are present in our data analysis, our results should not be fully taken into consideration. With our use of only two datasets, as well as the disregard for certain variables, we may have left out important information that may sway our results the other way. Our results definitely provide an understandable and basic consensus on the state of board games today, but without the full consideration of every possible angle and view of the topic area, we are unable to supply a fully correct conclusion. Others who view our report should consider that we only based our results off of the numbers and few words that were included in the dataset, rather than actually interviewing game-store owners or actual board game companies to learn about their opinions on the topic.

Challenge Goals:

Multiple Datasets

Our project can achieve this goal, because one dataset contains most of the data we need such as year published, play time, minimum age, complex rating, minimum amount of players, maximum amount of players, and domain of the game. Whereas, the other has BGG rating, average public rating, Geek rating, and number of people who own that board game.By combining these two datasets, we can consider more game statistics and see how they affect the game's success, and we have two different ways in which a game is successful in BGG, rating and rank.

New Library

Aside from using multiple datasets, our group will implement a new Python library to conduct the data analysis of our board game data. After examining the list of possible libraries to use, we decided that we can apply the functions of *Plotly*, in order to create more interactive

visualization charts for our datasets. Given these strategies, we should be able to achieve our goal of using a new library.

Work Plan Evaluation:

1) *Clean the datasets* ***[estimated time: 3 hours => actual time: 2 hours]***

Before creating any visualization plots and actually analyzing the data, we had to, first, clean the datasets themselves. Since we chose to work with multiple datasets as one of our challenge goals, we knew that cleaning the datasets will take a longer time than usual. We originally expected to take three hours to fully clean the multiple collections we had, but instead we spent a slightly shorter period of time in this stage. The process itself was not entirely time-consuming as they were each given in a convenient "csv format" and all we had to do was choose which specific columns we wanted to keep in our merged dataset. By using minimal lines of code, we were able to generate a single dataset that included each column of interest and excluded any "NaN" or other values that we did not want to analyze.

2) *Work on research questions and develop code/visualization charts* ***[estimated time: 15 hours => actual time: 15 hours]***

The next step of the process was to work on our research questions and develop the code and visualization charts that will answer them. We looked at the example projects provided earlier this quarter to develop a good consensus on how much time other groups spent during this stage of the project. We took the average amount of time that other groups put down and chose the round number of fifteen hours as our expected time. After actually diving into the code, we realized that we would not have to spend as much time as we expected because almost all of the visualization charts we needed to program shared very similar, if not exact, lines of code. The

new library we chose to employ, “Plotly,” made it easy to plot a specific visualization chart using specific columns for the x- and y-axes. We did end up encountering issues that caused us to make up the time that we actually cut earlier. After meeting with our teaching assistant, we tweaked some of our focus research questions in order to reduce redundancies in our results. We added an extra question as well to account for a certain area of our topic field that we left out upon first jumping into the project. These changes ended up causing us to actually complete the data analysis stage of our project in the same amount of time we expected, going into the project.

3) *Prepare the report* ***[estimated time: 10 hours => actual time: 13 hours]***

With the light revisions that we made to our research questions, in addition to a new research question, our report took a bit longer than expected to complete as we had to now analyze these aspects. We found that most of the sections that we have previously written for the project proposal were capable of being salvaged without major changes so we, more or less, completely recycled them into our final report. Writing up the new sections was not too difficult, considering our results were clear and made the data analysis process much easier. The part that did take the most time was writing up the actual results, though, simply because there were several questions that we analyzed. We just expected to spend less time because we only had three research questions at the time of our proposal, but after adding another research question that required a learning model to be implemented, we ended up spending a bit more time than expected.

<u>Testing:</u>

To test our results, we decided to implement a smaller dataset of dummy board games and analyze their plots when put into the same functions that we laid out in our main file. By

using a smaller dataset of only ten values, we know what each resulting plot should look like. If our plot does not match with the predetermined image we have, then there is a problem with how we set up our function. In each of the functions that we tested, though, each plot fully resembled our expected outcome, meaning we correctly programmed each function in our main file. All plots from our "board_game.py" file should be completely trusted based on our testing trials.

Collaboration:

Besides working with each other and consulting various teaching assistants for help on this project, the other resources we turned to throughout this process included numerous Stack Overflow and Github posts, board game data collectors on Kaggle, and fellow CSE163 classmates on EdStem. With the assistance provided by each of these resources, our project creation process became more bearable and allowed us to gather a deeper understanding of the material.