RAINBOW SIX SIEGE: EXPLORATORY DATA ANALYSIS PROJECT WRITE UP

USING UBISOFT OPERATION VELVET SHELL DATA SET

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ABSTRACT

R6 is a popular multiplayer shooting video game in which players play as either attackers or defenders. We're seeking to detect hidden trends and patterns in operators, maps, game types, and other factors using the R6 velvet shell data set in order to determine the best and worst operators, as well as the best weapons and attachments. Gamers and game creators would benefit from a deeper grasp of the operator's and map's strengths and limits.

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ABOUT THE GAME

Rainbow Six Siege is a tactical shooter that emphasises careful preparation, teamwork, and highly tuned tactical play. The game has developed greatly since its original release in 2015, with new stages, operators, weaponry, and seasonal events. (Playstation, n.d.)The game's basic concept is simple: each game has two teams of five or seven players, one as the Attacker and the other as the Defender. The Attackers are entrusted with breaching, clearing, and securing the objective, as the name indicates. Defenders must maintain the goal by fortifying key locations around the area and bolstering the building's entrances. (Ubisoft, n.d.)

PROJECT SUMMARY

The major goal of this project is to assist both gamers and developers in gaining relevant information. A certain operator may be more beneficial for a specific game mode, according to the participants. They can pick which operator is more strong and agile for a certain map when compared to other operators. R6's maps are distinct and unique in every way. As a result, a speedy operator may outperform a slower operator in specific maps with identical features. The operators can be compared based on their kill/death ratio. A newcomer to the realm of R6 might utilise this data analysis project to discover which operators are most commonly employed by more experienced R6 players. As a result of this research, newbie players may learn to play the game more quickly and become professionals. This project paper can also be used by developers to improve the game and its overall playability. For example, they may see if some operators are powerful in comparison to others by analysing their kill-to-death ratios, or if real-life gamers are favouring one operator over another. Developers can also utilise the project to enhance a certain operator that is being used less frequently. Some maps in R6 favour Attackers, while others favour Defenders. This causes a power imbalance on each map, making it tough for players. It is simple for a defence side to win games including hostage rescue operations mode, for example. This is due to the fact that the Attackers must kill Defenders while also protecting and rescuing the captives. As a result, the Attackers are burdened with keeping the prisoner alive. From a different perspective, this challenge may be thrilling for some but not for others. As a result, the creators can preserve the difficulty or change the map features to make the mode more balanced for both attackers and defenders. A player who prefers to play as an Attacker in Hostage Rescue missions can select the optimal combination of operators to complete the mission. As a result, the R6 data analysis project has a broad reach that will benefit both gamers and developers.

The questions which this project is trying to answer are as follows:

1. In each map, which are the most lethal attacker and defender operators? Is there any operator overpowered compared to others?
2. Which is the best primary weapon for the top three attacker and defender operator and the best accessories that can be fitted to the primary weapon to increase the kill?
3. There are numerous reasons for the team to win a round. Find out the best round win reasons.

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The above questions have not been changed from the project proposal. A question to find if any operator is incomparably better, was written as a separate question in the project proposal. But the same is incorporated along with the first question in this data analysis project.

SOURCES OF DATA AND DATA EXTRACTION

The data for R6 "Operation Velvet Shell" has been extracted from the official Ubisoft website. The data dump was provided by the Ubisoft R6 team game intelligence analyst, Geoffroy Mouret. These are datasets containing in-game data from the year 2017. It is also the data from the R6 Year 2 Season 1 game known as "Operation Velvet Shell". (Ubisoft, n.d.)

The dataset website link: https://www.ubisoft.com/en-us/game/rainbow-six/siege/news-updates/2fQ8bGRr6SlS7B4u5jpVt1/introduction-to-the-data-peek-velvet-shell-statistics.

In addition to this data, he stated that Ubisoft analysts work with a range of teams and are critical to the game's overall development. The Development Team decided to make certain in-game data public in order to inspire community members to do their own data analysis based on the fascinating figures they uncovered.

Three datasets are provided by the R6 team for public usage. These three datasets are arranged in according to the complexity of the analysis the analyst tend to work on. The three datasets are given below:

1. dataDump_s5_summary_operator_loadout.csv
   - Size of the file is 39MB
   - Major attributes which can be used are game platform, skill rank, operators and role, primary and secondary weapon, wins, kills, deaths, picks
   - Link:
     http://static2.cdn.ubi.com/pxm/RainbowSix/Data_Dump/dataDump_s5_summary_operator_loadout.zip

2. dataDump_S5_summary_objectives.csv
   - Size of the file is 767 MB
   - This dataset contains two more useful attributes including game mode and objective location.
   - Link:
     http://static2.cdn.ubi.com/pxm/RainbowSix/Data_Dump/datadump_S5_summary_objectives.zip

3. dataDump_S5.csv
   - Size of the file is 19GB. It is an extremely big data set. So, there was a need to slice the data for further processing.
   - Major attributes include all the primary and secondary weapon and its accessories, the round winning reason, round duration etc.
   - Link: http://static2.cdn.ubi.com/pxm/RainbowSix/Data_Dump/datadump_S5.zip

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For this project, the datadump S5 summary objective and whole data dump data set was used. As the datadump S5 data was huge, there was need to use python to slice the data into smaller datasets for easy processing. The whole S5 data set was sliced into 20 parts, with each file having the same number of columns and 1 million rows.

DATA PROCESSING AND ANALYTICAL METHODS

Data Slicing:

As mentioned in the project proposal, we anticipated a use of big-data software known as Apache Spark to process the big dataset we had. But without using Spark, we were able to process the data using only Python by reading only a million rows and storing into another csv file. By doing so, we were able to get 20 datasets having 1 million rows in each. But for the ease of handling the data, we used only the first million data which is sorted according to the date the game played. A dataset with one million was more than enough for us to analyse and solve the questions that were mentioned.

Necessary attributes in the data sets:

From the "summary objectives" data set, the necessary attributes taken for analysis are mapname, role, operator, nbwins, nbkills, nbdeaths, and nbpicks

- Mapname – It is the column which contains all the maps in the Operation Velvet Shell R6 game.
- Role – it is the column which mentions the role of the operator, which Attacker or Defender.
- Operator – it is the column with the operator names, Operators are the avatars inside the game which will be used by players. The operators are classified into attackers and defenders.
- nbwins – It is the number of wins
- nbkills – It is the number of kills made by the operator
- nbdeaths – It is the number of times the operator died
- nbpicks – it is the number of times the operator was picked.

From the "datadump S5" dataset, the necessary attributes taken for analysis are gamemode, mapname, winrole, endroundreason, role, operator, primaryweapon, primaryweapontype, primarysight, primarygrip, primaryunderbarrel, primarybarrel, nbkills, isdead, and haswon.

- Gamemode – it is the column which has the three game modes in a PvP game. That is BOMB, SECURE AREA, and HOSTAGE.
- Winrole – this column shows the role of the operator which won the round. (Attacker/Defender)
- Endroundreason – this column shows the reason why the team won the round. There are multiple reasons for the team to win such as all the attackers eliminated, or the bomb exploded etc.

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- Primaryweapon – the column which shows the name of the primary weapon used by the operator.
- Primaryweapontype – type of the primary weapon such as assault rifle, shot gun, shield etc
- Primarysight – the name of the sight fitted in the weapon such as Acog, Red dot, reflex etc
- Primaryunderbarrel – the name of the underbarrel fitted to the primary weapon such as Laser, spectator etc
- Primarybarrel – the name of the barrel fitted on to the primary weapon such as flash, compensator, suppressor etc
- Isdead – it is another name given nbdeath for the column
- Haswon – the number of wins

Data cleaning and pre-processing:

The cleaning and pre-processing of data was completely done in python. Python libraries such as Pandas and Numpy were used for almost all of the cleaning processes. For the analysis of finding the best operator in each map, the "summary objectives" data set was used. The dataset consisted of numerous attributes which were useless for the question we tend to find the answer for. There was a need to remove these columns from the dataset. For the other two questions, the bigger data set, which is "datadump s5", was used. According to the two questions, two new datasets with the required set of attributes were created from the original dataset.

There was a need to filter out the data with low number of kills. Therefore, the data containing number of kills less than 20 kills were filtered out. Similarly, for some rows, the value of number of deaths was zero. This created a problem when the kill ratio was calculated. Kill ratio is the ratio between number of kills to the number of deaths. So, when an integer value was divided by zero, it resulted in infinity, which will result in a failed analysis. So, the data containing zero deaths were deleted.

For the third question, that is to find the relation between end round reason and the number of wins, there was a need to tidy the game mode column. The game mode column contained an unrecognizable character along with the string "PvP". There was the need to take only the BOMB, HOSATGE and SECURE AREA string neglecting all the other characters. So, the column was cleaned by taking only the above-mentioned string.

Analytical methods:

There are various analytical methods used in this project. For exploratory data analysis, bar plots, lollipop plots and heatmaps are used. These plots were drawn with the help of three different python libraries. These are matplotlib, seaborn and plotly. Seaborn was mainly used to plot heatmaps because of the ease of plotting heatmaps with it. The other two were used to plot bar plots and lollipop graphs.

Bar plots are plots used to compare different items with respect to a dependent variable. In this project, bar plots are mainly used to compare different operators with respect to a dependent

variable, which can be the kill ratio, win ratio or just the number of kills. Lolli pop plots are used to plot kill ratio with respect to different operators. Heatmaps are used in various occasions. It is used to compare maps and operators with respect to kill ratio, or to compare maps and winning reasons with respect to the number of round wins.

Other statistical analysis methods used are mainly mean and maximum values. In various stages of the analysis, mean of kill ratio and win ratio has been taken with respect to different game modes, maps and operators. In other times, the maximum value of kills or wins has been taken with respect to different categories. The usage of maximum can be mainly seen in question 2 for finding the best primary weapon and its accessories.

PROJECT ANALYSIS

Question 1:

By recognising the top operators on each map, players may improve their gameplay. Professional and skilled players like to pick particular operators on each map based on their experience gained over many rounds. Inexperienced players, on the other hand, may lack the expertise required to choose the proper operators based on the map. Here, we try to find the best operator for both attackers and defender in each map.

Heatmaps are generated to show an overall performance of operators with respect to each map. Different lollipop plots with operators on the X-axis and Kill ratio on the Y-axis are generated to analyse the situation more specifically. The definition and usage of both heatmaps and lollipop plots are mentioned in the analytical methods portion of this project writeup. The operator's kill ratio is the number of kills divided by the number of deaths. The win ratio, which is the number of wins divided by the number of picks, is not used in this evaluation. This is because kill ratio is unique to that operator, but win ratio is specific to the team in which that operator participated. We prefer to overlook win ratio because the purpose of our query is to determine the best individual operator.

There are 16 different maps in R6. They are named as BANK, BARTLETT U., BORDER, CHALET, CLUB HOUSE, COASTLINE, CONSULATE, FAVELAS, HEREFORD BASE, HOUSE, KAFE DOSTOYEVSKY, KANAL, OREGON, PLANE, SKYSCRAPER and YACHT. We try to visualize the performance of both attacker operators and defender operators for each individual map.

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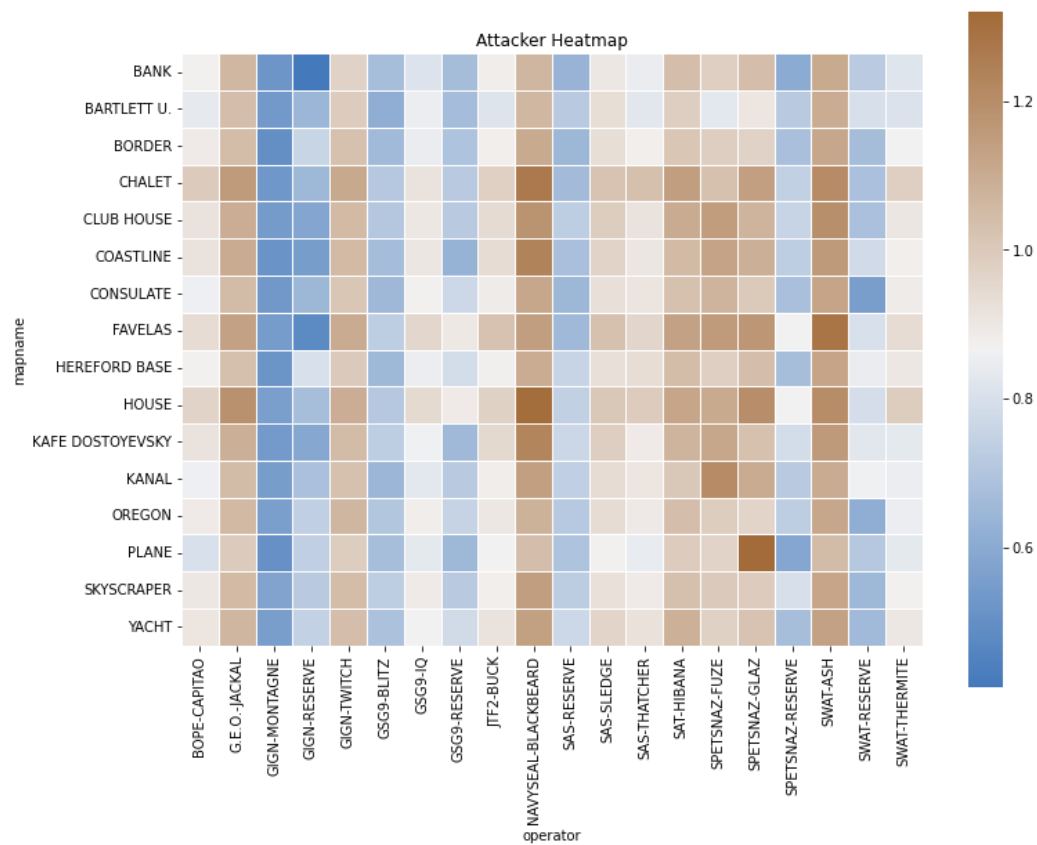bs330@student.le.ac.uk

Fig 1. Heat map of attacker operators vs maps

Figure 1 represents the heatmap between operators and maps for the attacker role with respect to the kill ratio.
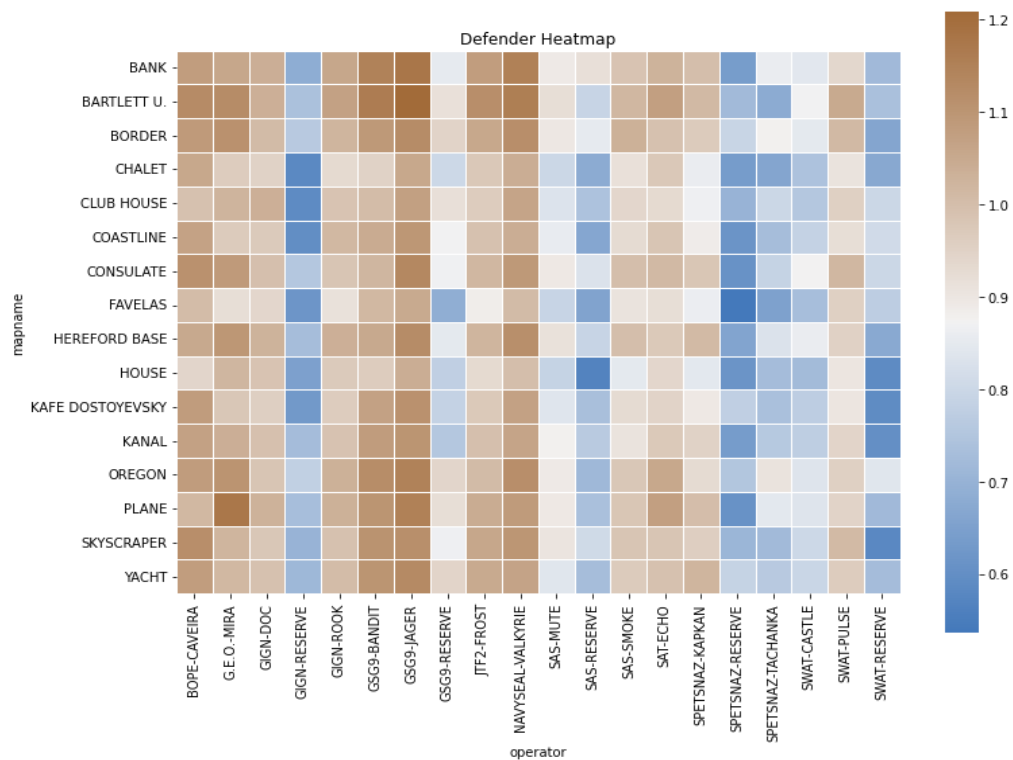
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Figure 1 represents the heatmap between operators and maps for the defender role with respect to the kill ratio.

As we can observe from both plots, the reserve operators tend to perform worse than any other operators. Reserve operators are backup operators in the R6 game. So we can filter out reserve operators and plot the heatmap with real operators.
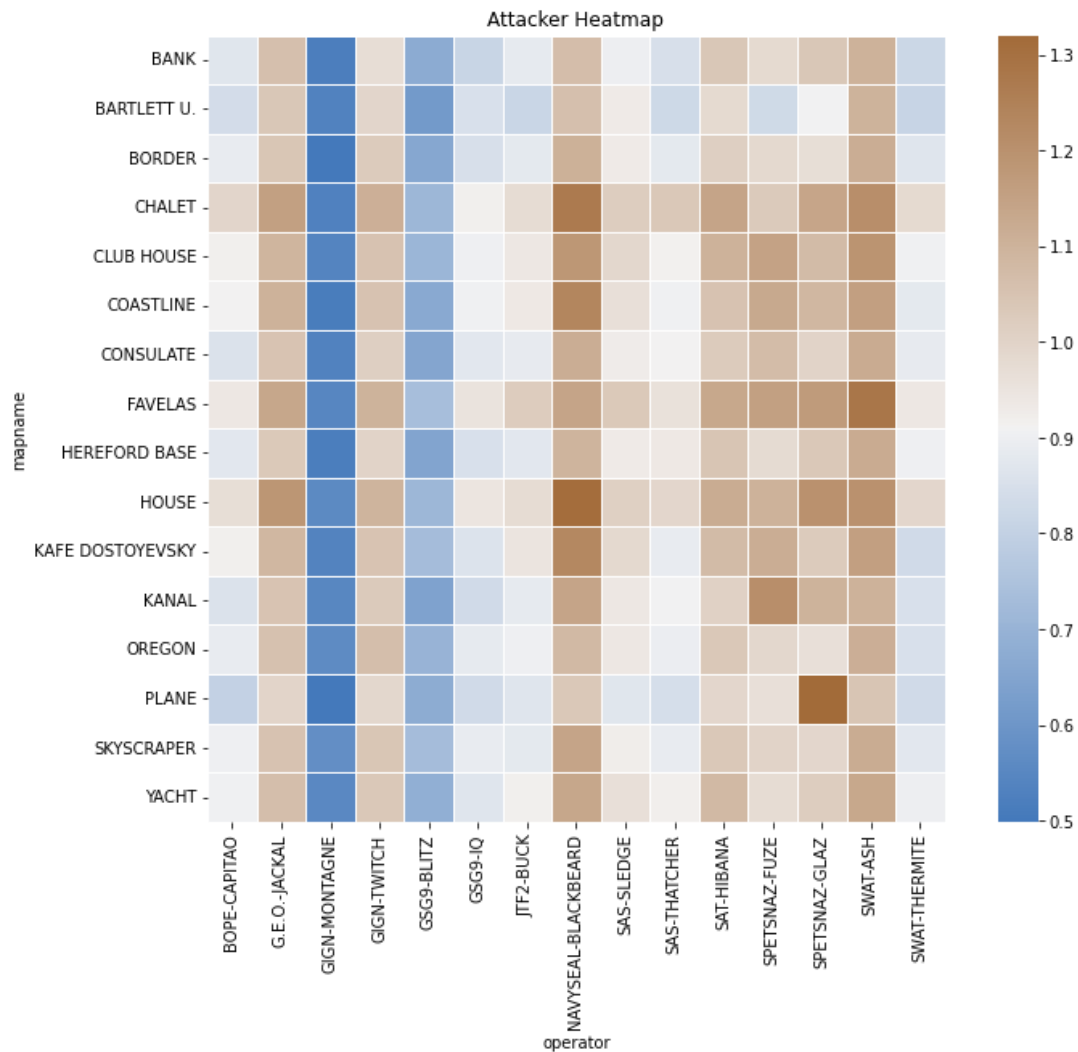

Fig 3. Operators vs maps (Without Reserves) – Attacker

Figure 3 represents the heatmap between operators and maps, without reserves, for the attacker role with respect to the kill ratio.

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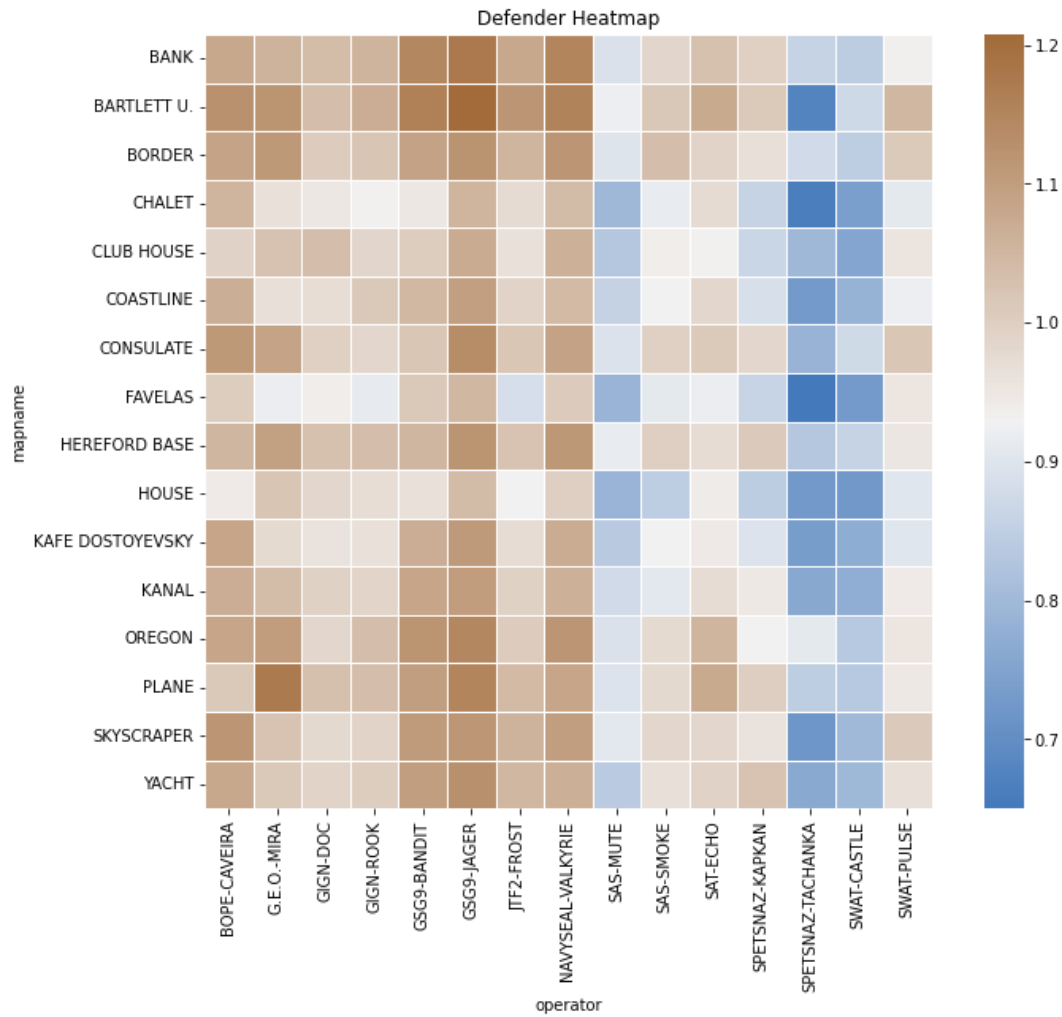RAINBOW SIX SIEGE
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Fig 4. Operators vs maps (Without Reserves) – Defender

Figure 4 represents the heatmap between operators and maps, without reserves, for the defender role with respect to the kill ratio.

As we can observe from both heatmaps, some operators tend to perform than other operators almost for all the maps. For the attacker role SWAT-ASH, G.E.O.-JACKAL, NAVYSEAL-BLACKBEARD are some of the names who are performing better. For the defender role GSG9 – JAGER, JTF2-FROST, NAVYSEAL-VALKYRIE are some of the operators performing better. But by the use of heatmaps, we cannot confirm who is the best performer in each map. To solve this, we try to plot operators and their kill ratio for each map

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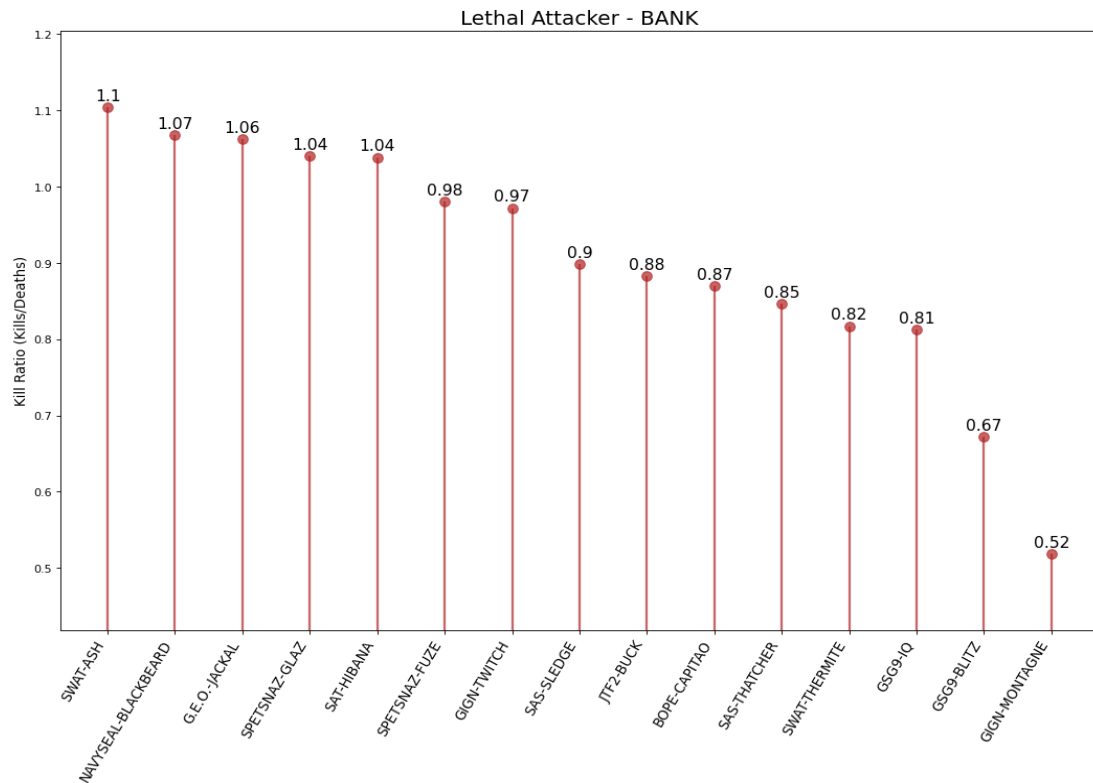219029907 (bs330)
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Fig 5. Operators vs Kill ratio (Attacker – BANK)
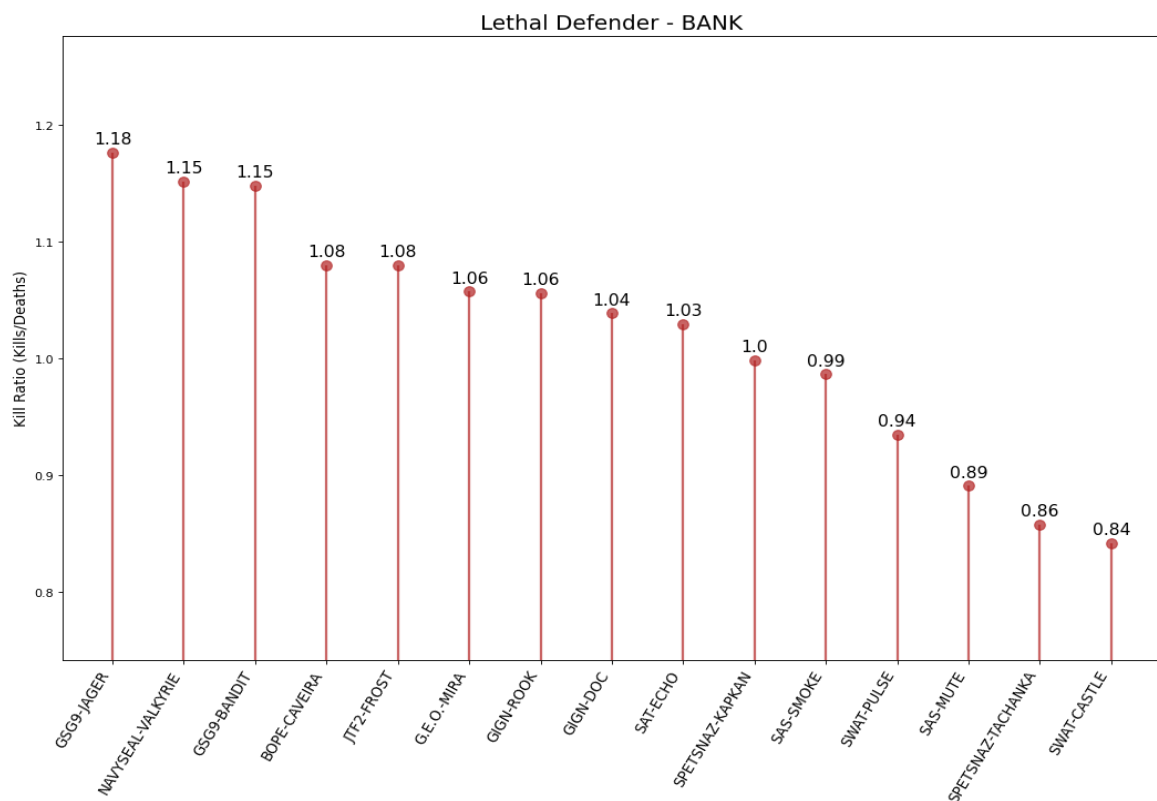
Fig 6. Operators vs Kill ratio (Defender – BANK)

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Figure 5 and 6 represents the lollipop plot between operators vs kill ratio for the map - Bank. Figure 5 is represented for attacker role whereas figure 6 for defender role.

Among the attacker role, we can observe that the operator SWAT-ASH has the best kill ratio (kill ratio – 1.1) in the map BANK. NAVYSEAL-BLACKBEARD is a close second with a kill ratio of 1.07. Among the defender role, it can be observed that the operator GSG9-JAGER has the highest kill ratio (1.18) with NAVYSEAL-VALKYRIE coming second with a kill ratio of 1.15.

So, it is evident that SWAT-ASH and GSG9-JAGER are the best two operators for the map BANK.
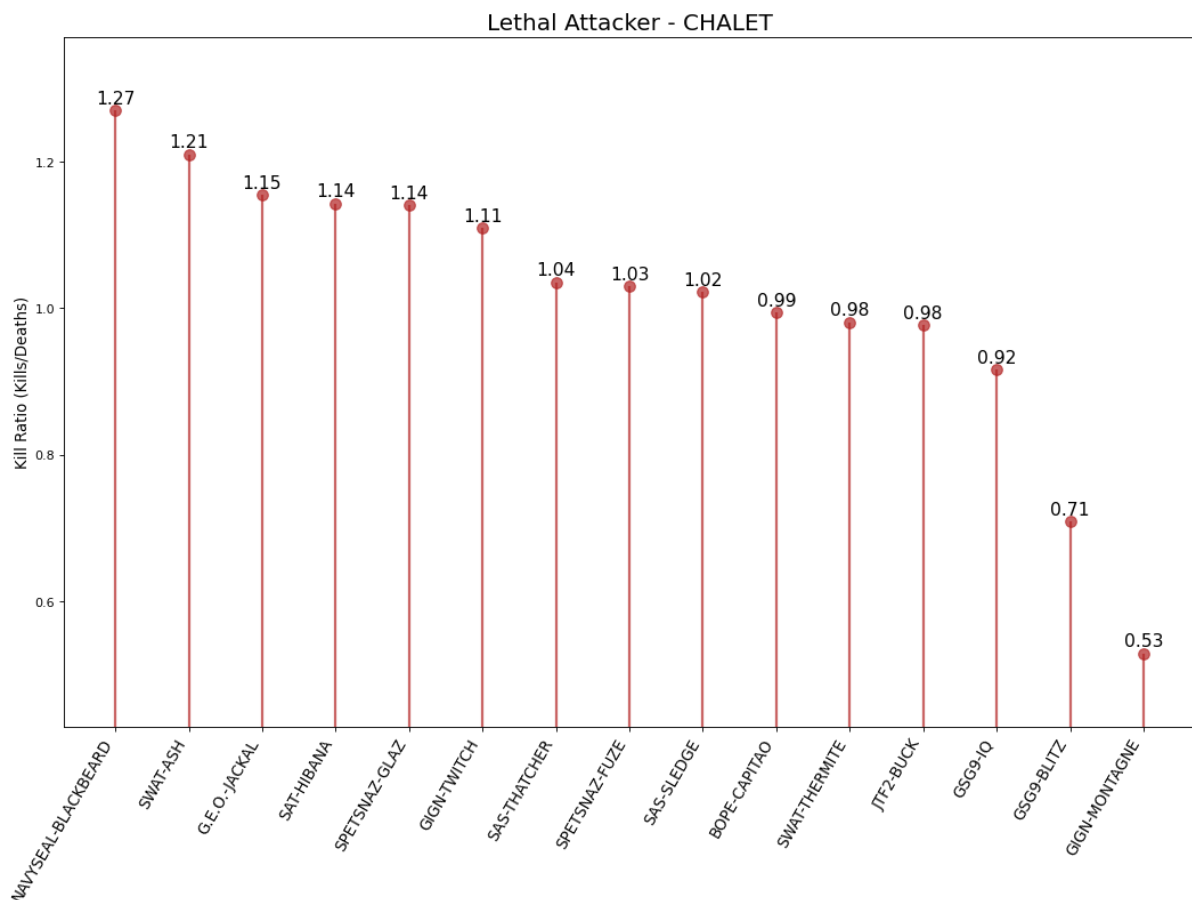
Map name – CHALET

Fig 7. Operators vs Kill ratio (Attacker – CHALET)

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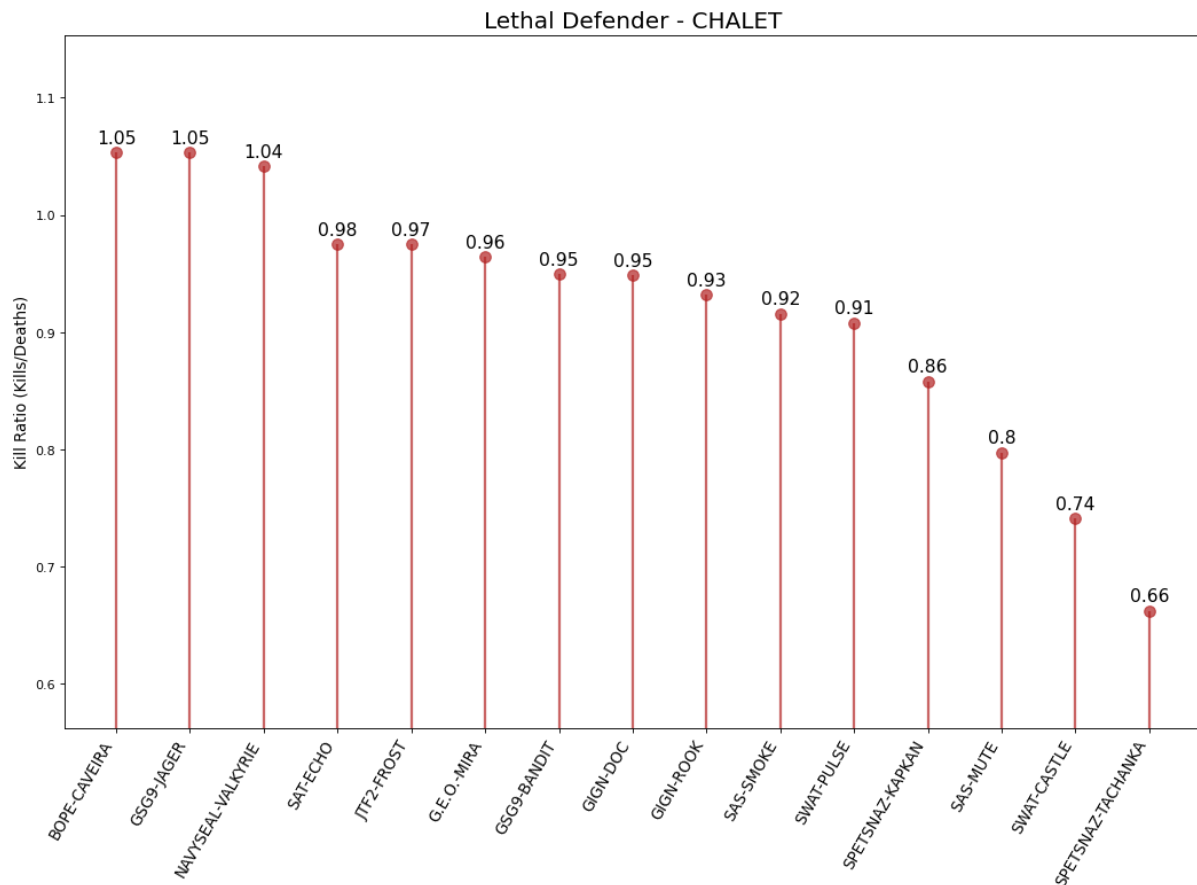RAINBOW SIX SIEGE
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Fig 8. Operators vs Kill ratio (Defender – CHALET)

Figure 7 and 8 shows the plot of operator vs kill ratio of the map CHALET for attackers and defenders respectively.

In the map CHALET, the operator NAVYSEAL-BLACKBEARD has the best kill ratio (kill ratio – 1.27) among the attacker roles. With a kill ratio of 1.21, SWAT-ASH is a close second. BOPE-CAVEIRA and GSG9-JAGER have the greatest kill ratio (1.05.) among the defensive roles. As a result, the best operators for the map CHALET are NAVYSEAL-BLACKBEARD, BOPE-CAVEIRA, and GSG9-JAGER.

Map name – KANAL

For the map KANAL, it is observed that SPETSNAZ-FUZE is the best among attackers with a kill ratio of 1.21. NAVYSEAL-BLACKBEARD comes second with a kill ratio of 1.14. For the defender role, GSG9-JAGER has the best kill ratio value of 1.1 with GSG9-BANDIT coming in at second with a kill ratio of 1.08. So, it can be said that SPETSNAZ-FUZE and GSG9-JAGER are the best at KANAL with higher kills and lower deaths. Figure 9 and figure 10 shows the plot of attacker and defender operators for the map KANAL.

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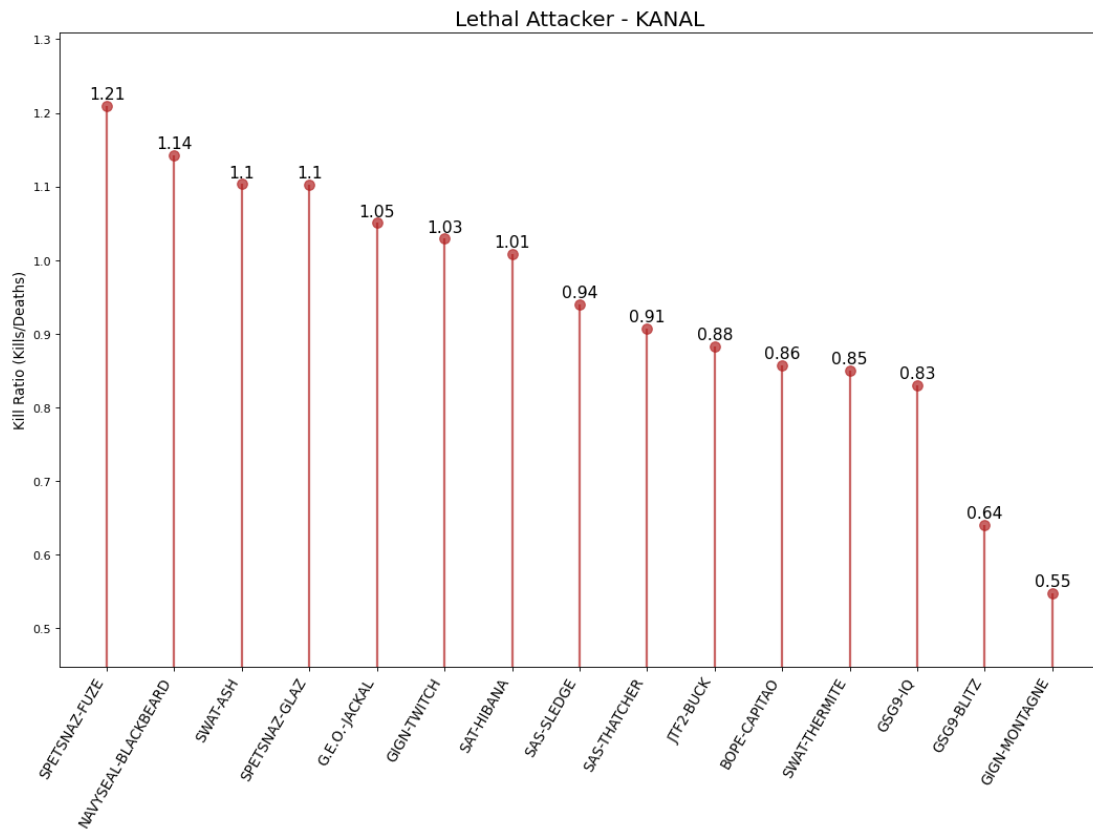
Fig 9. Operators vs Kill ratio (Attacker – KANAL)
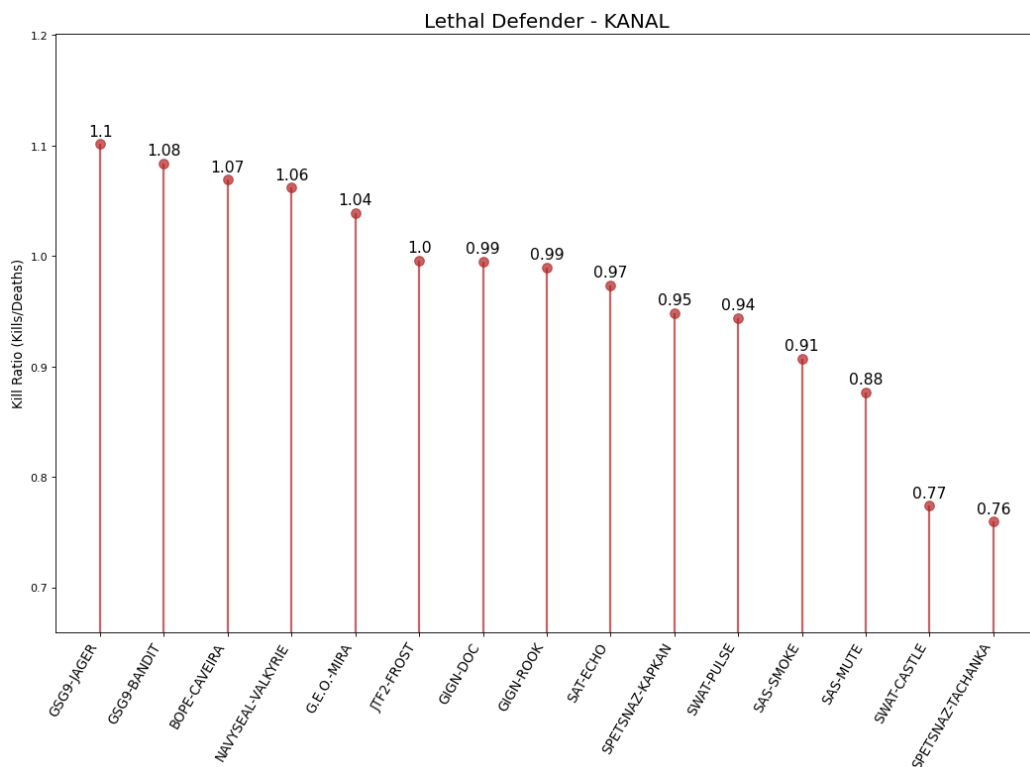
Fig 10. Operators vs Kill ratio (Defender – KANAL)

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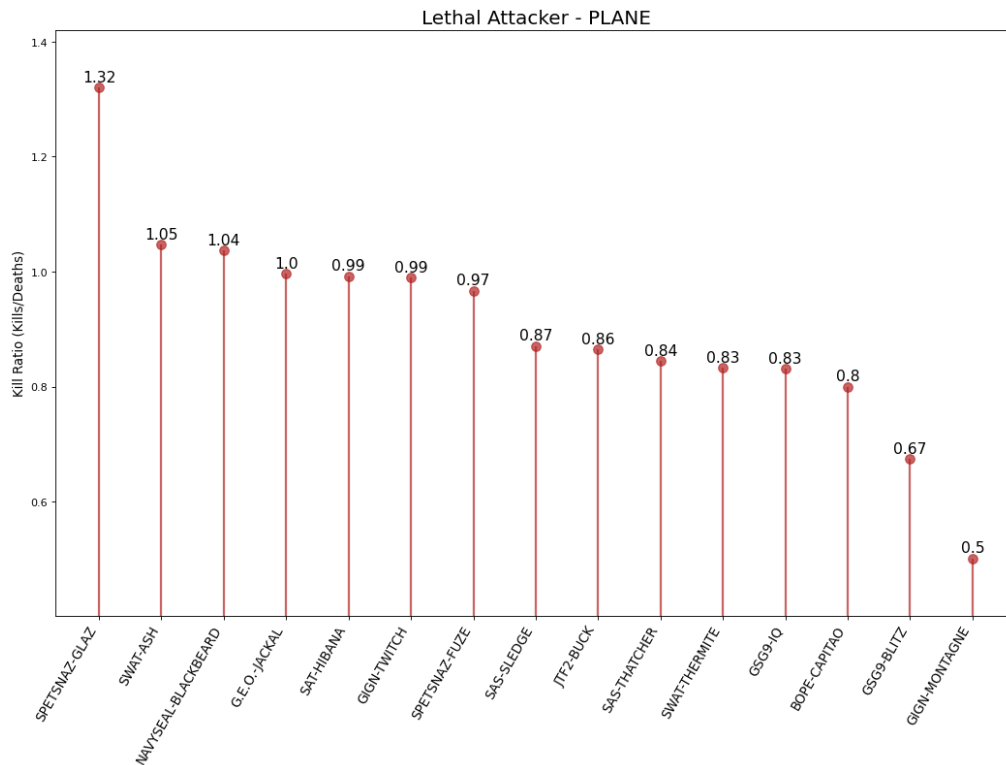
Fig 11. Operators vs Kill ratio (Attacker – PLANE)

The above plot shows that the operator SPETSNAZ-GLAZ performed far better than any other attacker operator for the map PLANE. SPETSNAZ-GLAZ has a 1.32 kill ratio with no one coming close. So, it is evident that SPETSNAZ-GLAZ is the best killer in the PLANE map among all the other attacker operators.

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Fig 12. Operators vs Kill ratio (Defender – PLANE)

Figure 12 shows that the GEO-MIRA operator has the highest kill rate among defender operators. She has a kill ratio of 1.17. GSG9-JAGER comes second with a kill ratio of 1.15. So, the data proves that GEO-MIRA is the best killer in the map PLANE for the defender role.

Consolidated results:

It will be repetitive to plot the operator kill ratios for all the other 12 maps. Some of the operators are repetitively occupying the first spot when we analysed the data for all the maps. Therefore, a consolidated result is presented in the table 1 below.

Mapname	Attacker operator	Defender operator
BANK	SWAT-ASH	GSG9-JAGER
BARTLETT U.	SWAT-ASH	GSG9-JAGER
BORDER	SWAT-ASH	GSG9-JAGER
CHALET	NAVYSEAL-BLACKBEARD	BOPE-CAVEIRA
CLUB HOUSE	SWAT-ASH	GSG9-JAGER
COASTLINE	NAVYSEAL-BLACKBEARD	GSG9-JAGER
CONSULATE	SWAT-ASH	GSG9-JAGER
FAVELAS	SWAT-ASH	GSG9-JAGER
HEREFORD BASE	SWAT-ASH	GSG9-JAGER
HOUSE	NAVYSEAL-BLACKBEARD	GSG9-JAGER
KAFE DOSTOYEVSKY	NAVYSEAL-BLACKBEARD	GSG9-JAGER
KANAL	SPETSNAZ-FUZE	GSG9-JAGER
OREGON	SWAT-ASH	GSG9-JAGER
PLANE	SPETSNAZ-GLAZ	G.E.O.-MIRA
SKYSCRAPER	NAVYSEAL-BLACKBEARD	BOPE-CAVEIRA
YACHT	NAVYSEAL-BLACKBEARD	GSG9-JAGER

Table 1. Consolidated results of best attacker and defender operators with respect to map

From the above table, it is clear that SWAT-ASH and NAVYSEAL-BLACKBEARD are the best two operators for the attacker role. SWAT-ASH has the highest kill ratio for 8 maps while NAVYSEAL-BLACKBEARD has the highest kill ratio for 6 maps. For the defender role, it can be observed that GSG9-JAGER the highest kill ratio in 13 maps.

Getting the highest kill ratio in individual maps might not mean that the particular operator is best among the others. We need to find the mean kill ratio of the operators for all the maps combined to know which operators are the best among attacker and defender roles.

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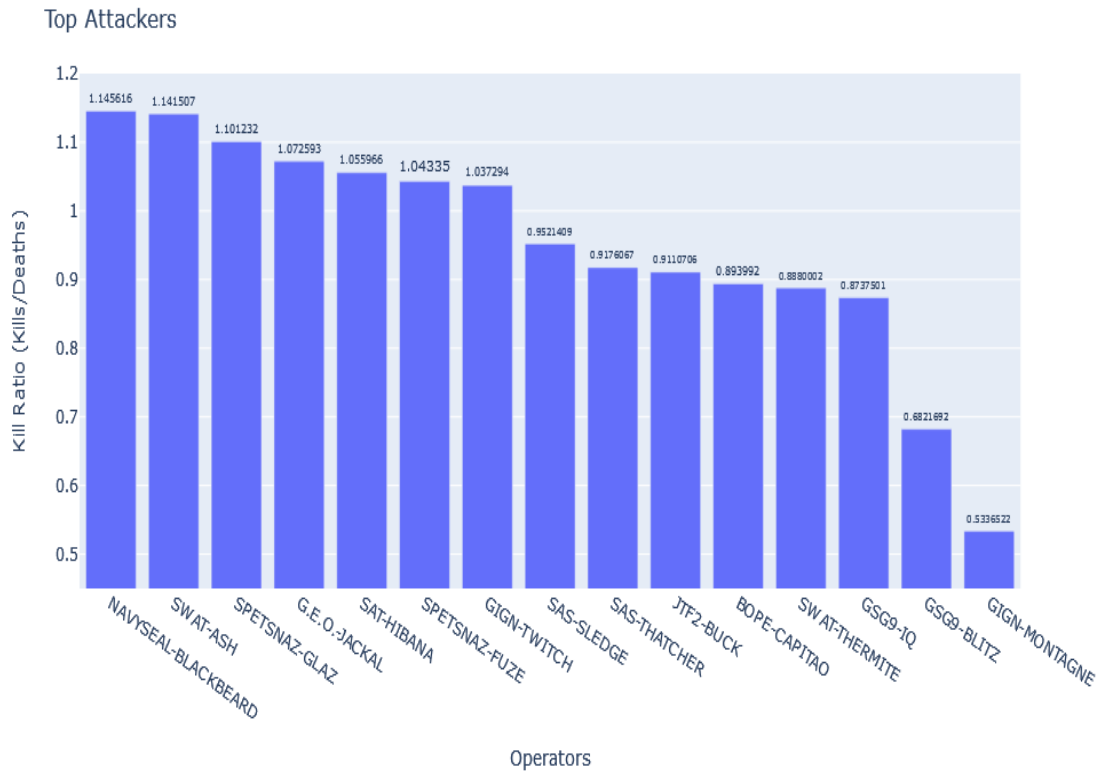
Fig 13. Operators vs Mean Kill ratio (Attackers)
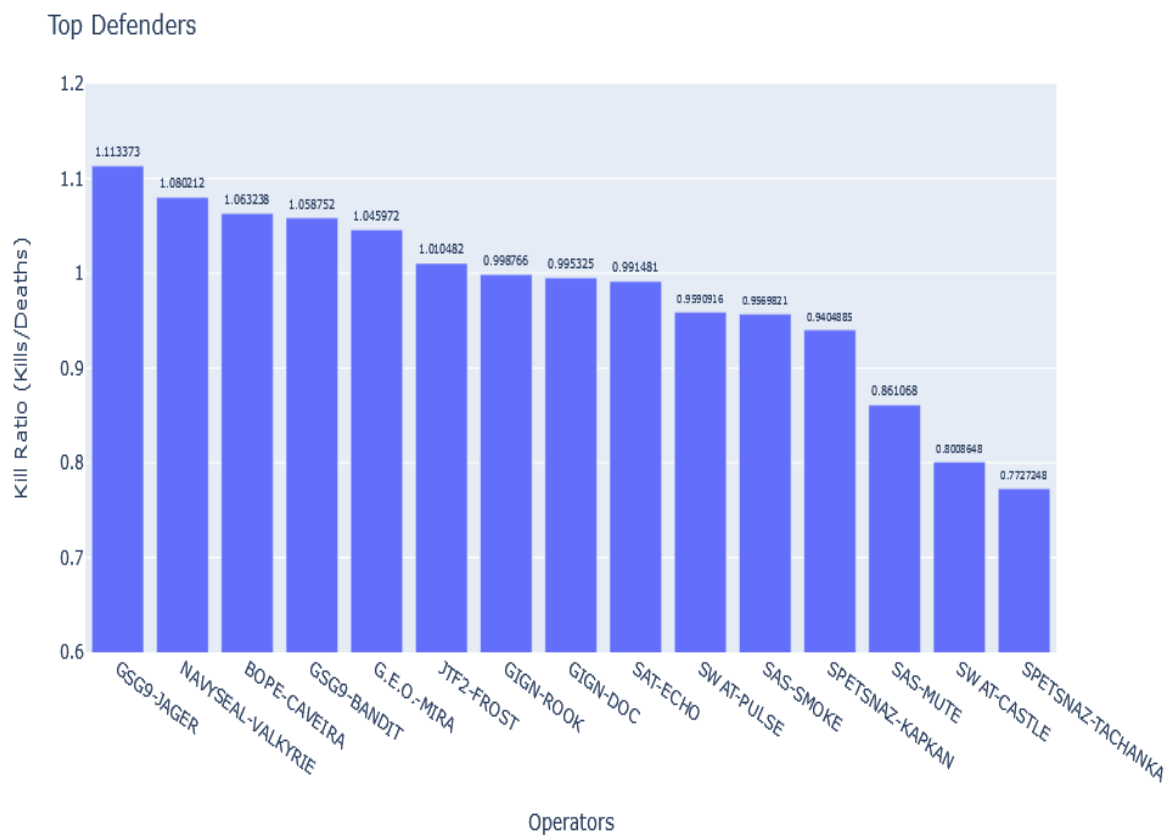
Top Defenders

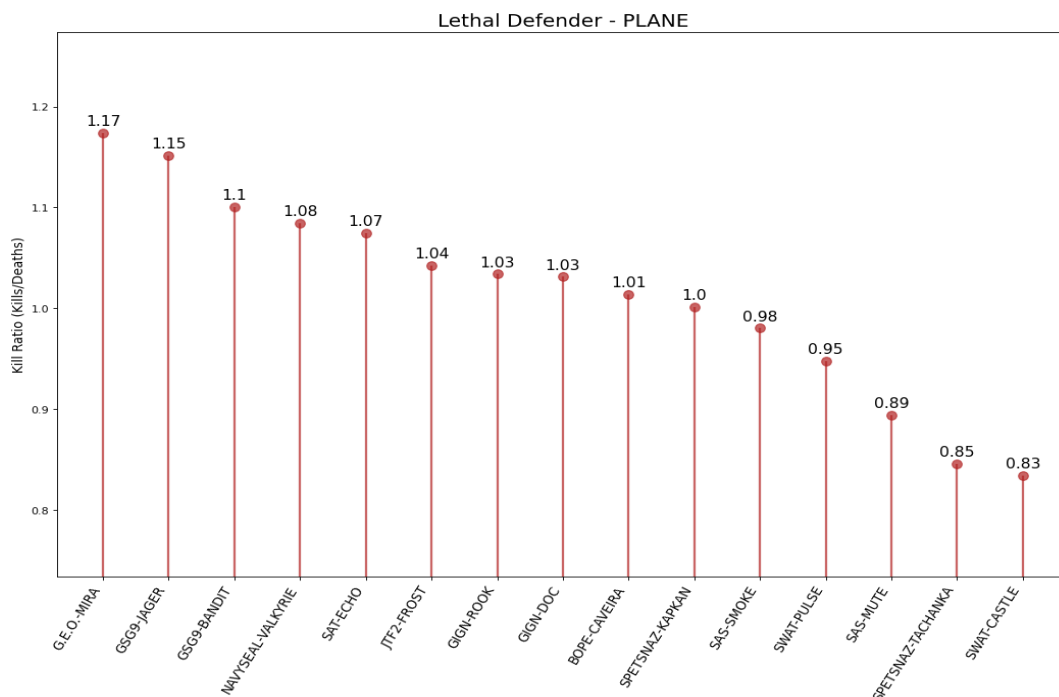Fig 14. Operators vs Mean Kill ratio (Defenders)

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From figure 13, it can be observed that NAVYSEAL-BLACKBEARD has the highest mean kill ratio with a value of 1.145 for the attacker role. SWAT-ASH comes second with a value of 1.141.

For defenders, it can be observed that GSG9-JAGER is the clear winner with a kill ratio of 1.113 mean kill ratio. This is evident from figure 14. NAVYSEAL-VALKYRIE comes second with a kill ratio of 1.08.

Question 2:

Certain attachments tend to produce better outcomes for each operator. Precision, accuracy, and recoil may all be improved or lessened by connecting attachments to each primary weapon. Although each player's choice for these attachments may vary, they typically produce comparable game outcomes. We try to find out which attachments are the best for the finest primary weapons of the top operators and then recommend them to gamers.

We observed from the previous question that the top operators, who have the highest kill ratios, are NAVYSEAL-BLACKBEARD, SWAT-ASH, SPETSNAZ-GLAZ, GSG9-JAGER, NAVYSEAL-VALKYRIE and BOPE-CAVEIRA. Among these operators NAVYSEAL-BLACKBEARD, SWAT-ASH, and SPETSNAZ-GLAZ are attacker operators and GSG9-JAGER, NAVYSEAL-VALKYRIE and BOPE-CAVEIRA are defender operators. Here, we try to find the best primary weapon for these operators. After finding the best primary weapon, we try to find the best attachments that can be fitted to these weapons to maximize the kill rate. Only the number of kills is taken as dependent variable for this particular analysis. This is because of the fact that kills are made solely by the weapon. If we considered the kill ratio, which is a relative variable of kills and deaths, there is an influence of deaths which is a factor that is not particularly related to weapon of choice. Death rate is related mainly to the movement, speed and armour of the operator. So we neglect the death attribute in this question.

Operator 1 - NAVYSEAL-BLACKBEARD
NAVYSEAL-BLACKBEARD has two primary weapons – MK17 CQB and SR-25. Let us now check which is the best primary weapon among those two

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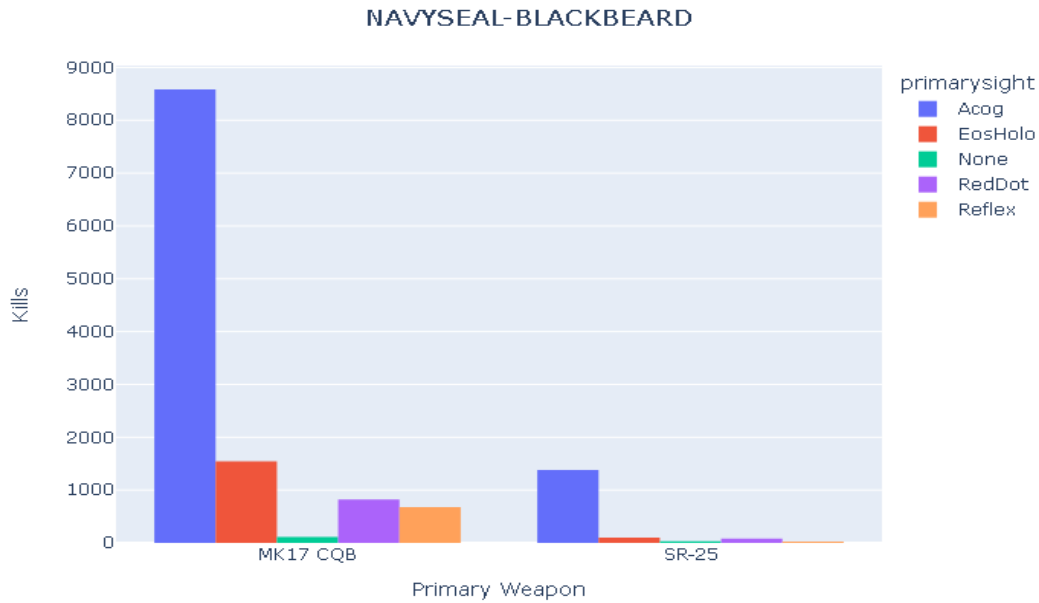bs330@student.le.ac.uk

Fig 15. Primary weapon vs Kills – with primary sight (NAVYSEAL-BLACKBEARD)

The best primary weapon with the most kills is MK17 CQB. It is an assault rifle. From figure 15, it can be observed that the best primary sight attached to MK17 CQB is Acog. Because it has the greatest number of kills. Let us now take just the primary weapon MK17 CQB and the best primary sight Acog then do the further analysis with only these two.
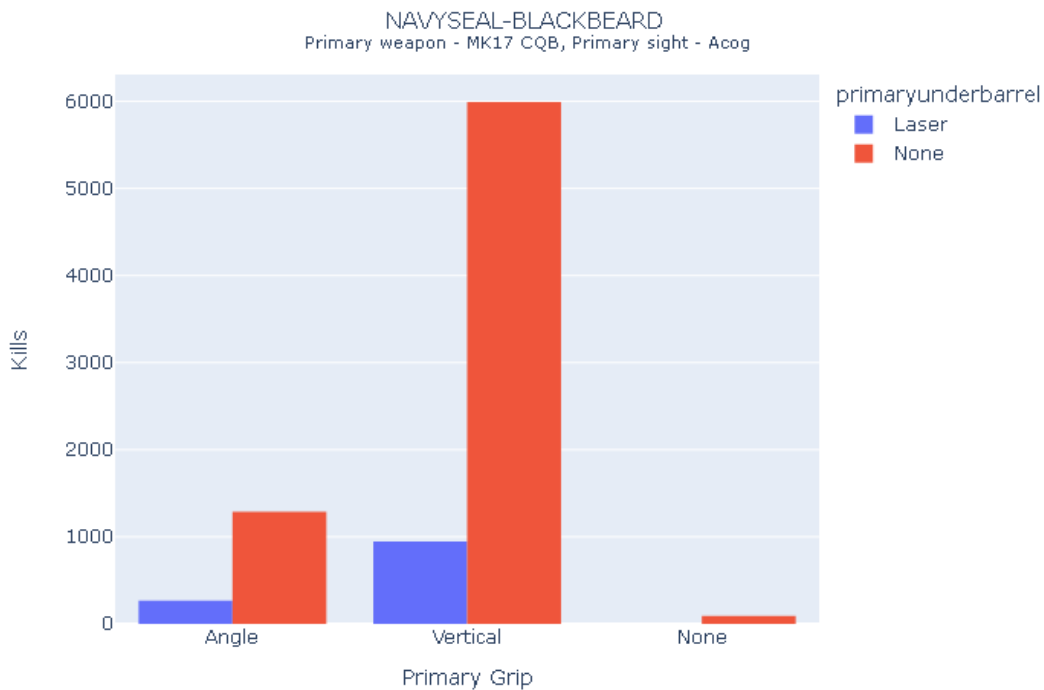

Fig 16. Primary grip vs Kills – with primary under barrel (NAVYSEAL-BLACKBEARD)

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After filtering the data with only MK17 CQB and Acog, we found that the best performing grip for the primary weapon is "vertical" and the data suggests that the under barrel with the most kills is "None". That means when the primary weapon is not fitted with any under barrel.

Let us filter the data with primary weapon as MK17 CQB, sight as Acog, grip as vertical and under barrel as "none".
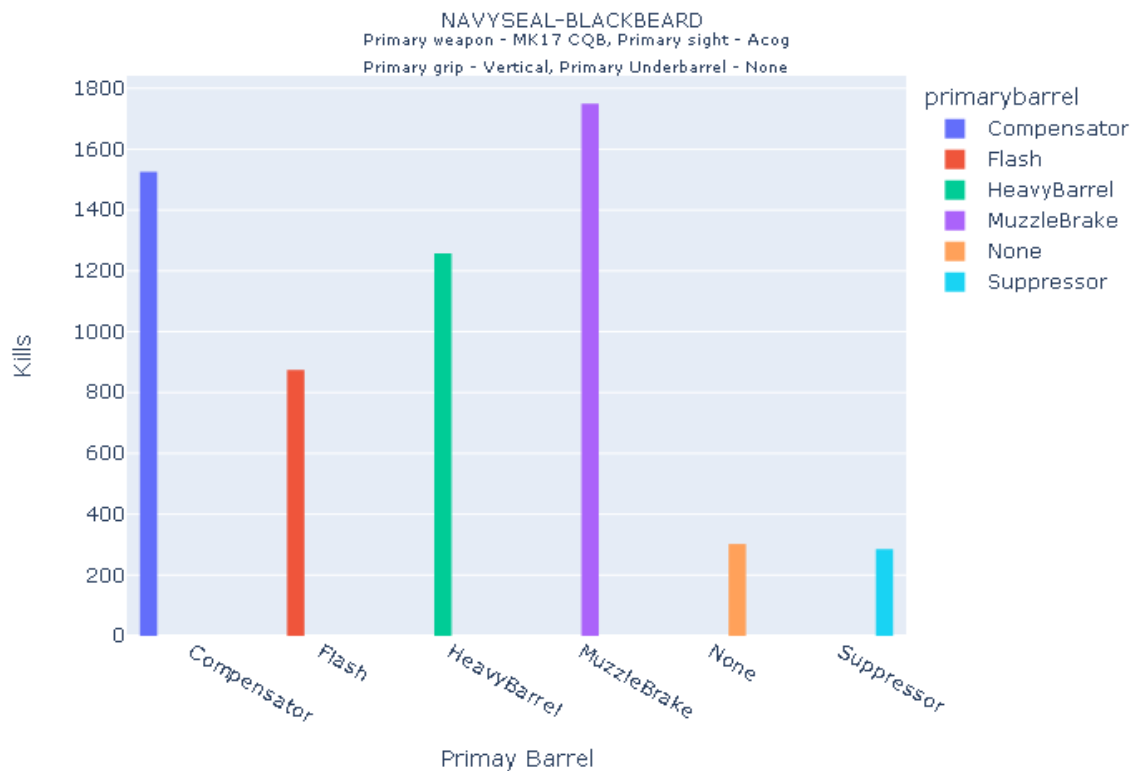

Fig 17. Primary barrel vs Kills (NAVYSEAL-BLACKBEARD)

The above plot indicates that the best primary barrel for the selected combination of weaponry is Muzzle Brake with the most kills among other barrels. The compensator comes second after Muzzle Brake.

Thus, the data conveys that the best combination for the primary weapon for the operator NAVYSEAL BLACKBEARD is as follows:

Primary weapon – MK17 CQB

Primary Sight – Acog

Primary Grip – Vertical

Primary under barrel – None

Primary Barrel – Muzzle Brake

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Operator 2 – SWAT-ASH

SWAT-ASH has two primary weapons – G36C and R4-C. Both G36C and R4-C are assault rifles. Let us find out the best weapon among these two.
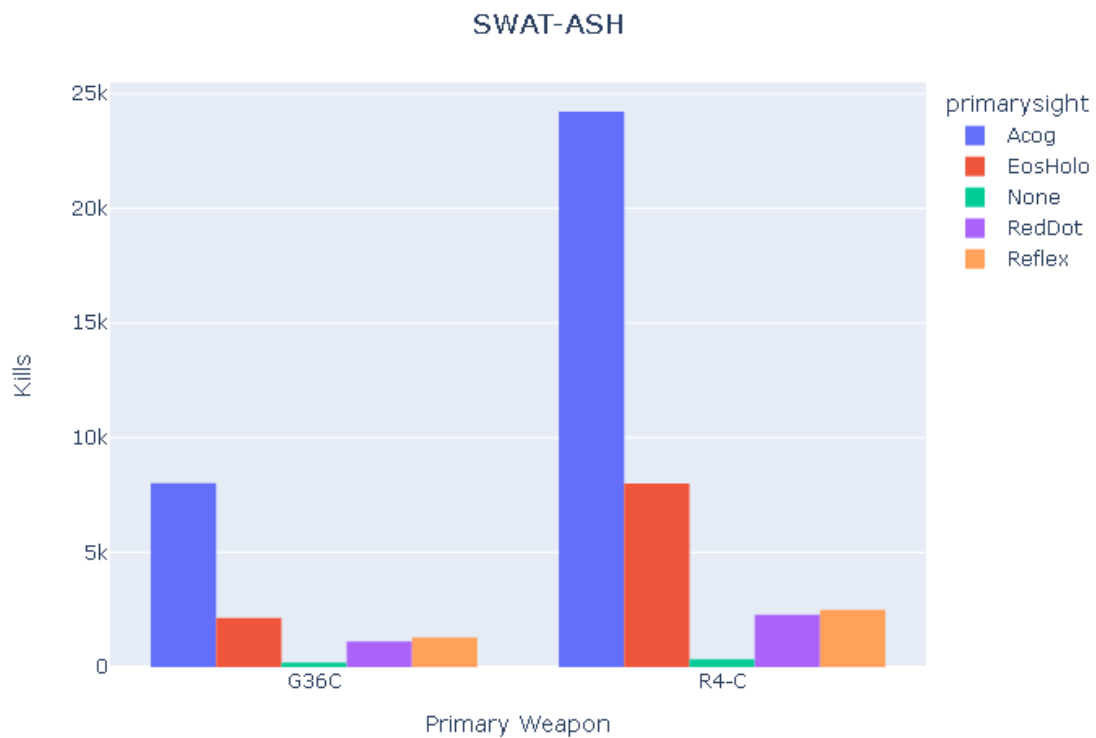
Fig 18. Primary weapon vs Kills – with primary sight (SWAT-ASH)

R4-C is the top primary weapon in terms of kills. Figure 18 shows that Acog is the best main sight linked to R4-C due to the fact that it has the most kills. Let's pick only the primary weapon R4-C and the finest primary sight Acog and complete the rest of the study with just those two.

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SWAT-ASH
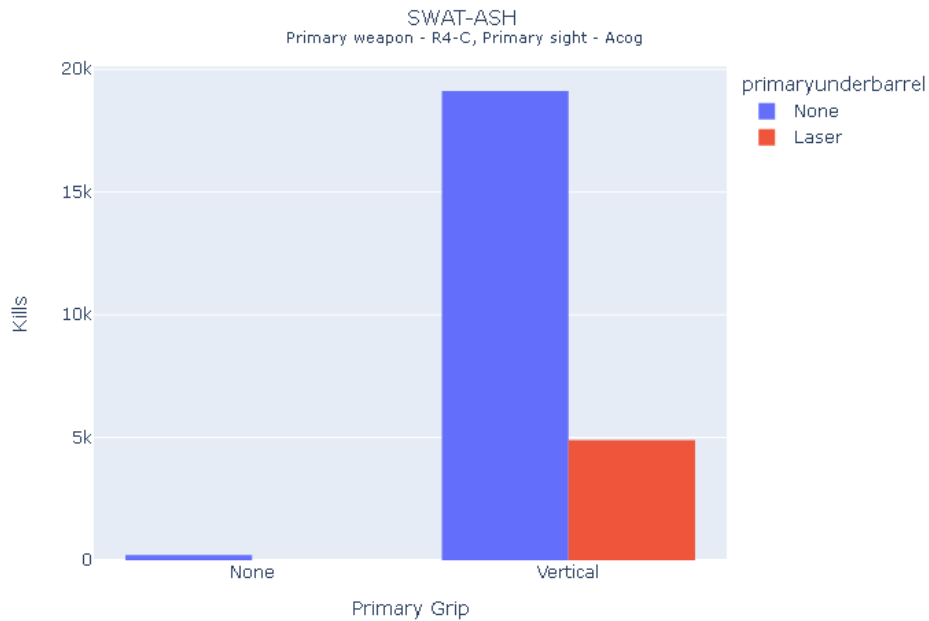Primary weapon - R4-C, Primary sight - Acog

Fig 19. Primary grip vs Kills – with primary under barrel (SWAT-ASH)

We discovered that the highest performing grip for the primary weapon is "vertical," and that the under barrel with the most kills is "None" after filtering the data with just R4-C and Acog. That is, when the primary weapon is not equipped with any underbarrel. Let us look at the data with the primary weapon set to R4-C, the sight set to Acog, the grip set to vertical, and the under barrel set to "none."

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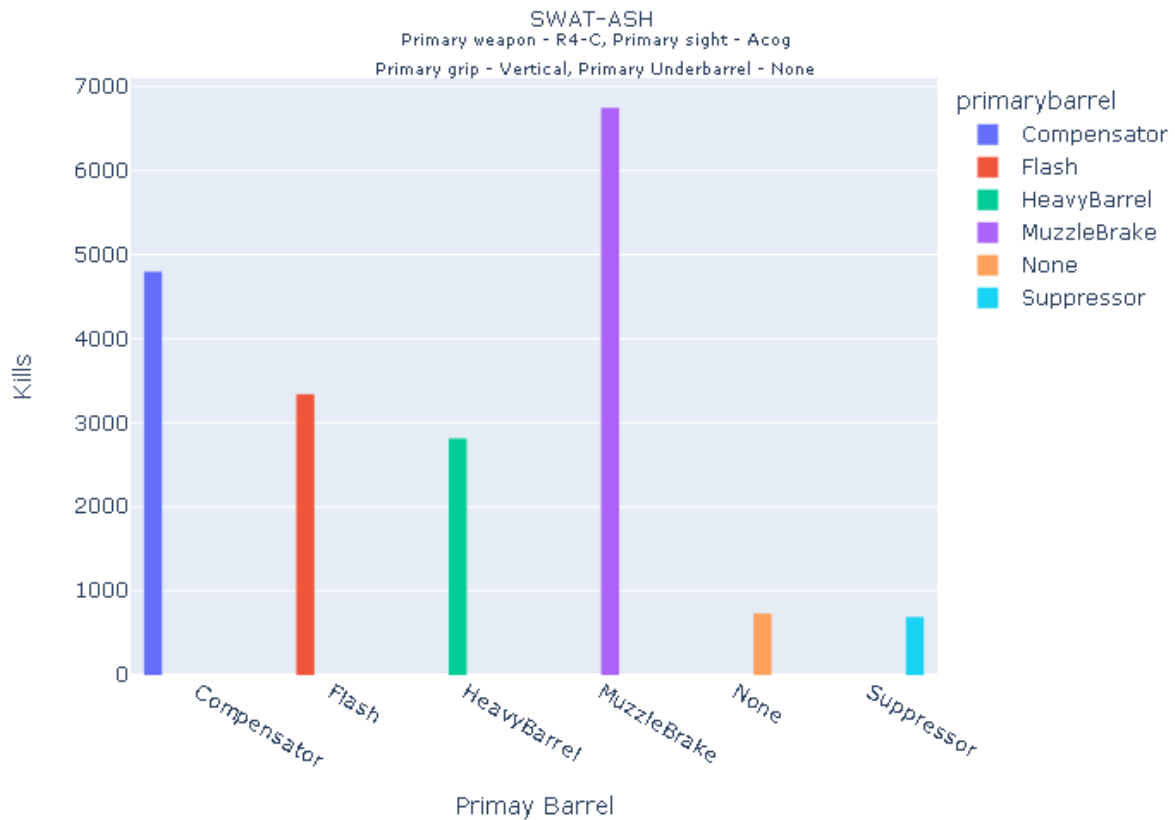
Fig 20. Primary barrel vs Kills (SWAT-ASH)

The above graph shows that the Muzzle Brake is the best main barrel for the selected weapons combination, with the most kills. After Muzzle Brake, the compensator comes in second.

As a result of the statistics, the operator SWAT-ASH's optimal primary weapon combination is as follows:

Primary weapon – R4-C

Primary Sight – Acog

Primary Grip – Vertical

Primary under barrel – None

Primary Barrel – Muzzle Brake

Operator 3 – GSG9-JAGER

GSG9-JAGER has two primary weapons – 416-C CARBINE and M870. 416-C CARBINE is an assault rifle while M870 is a shotgun. Let us find out the best weapon among these two.
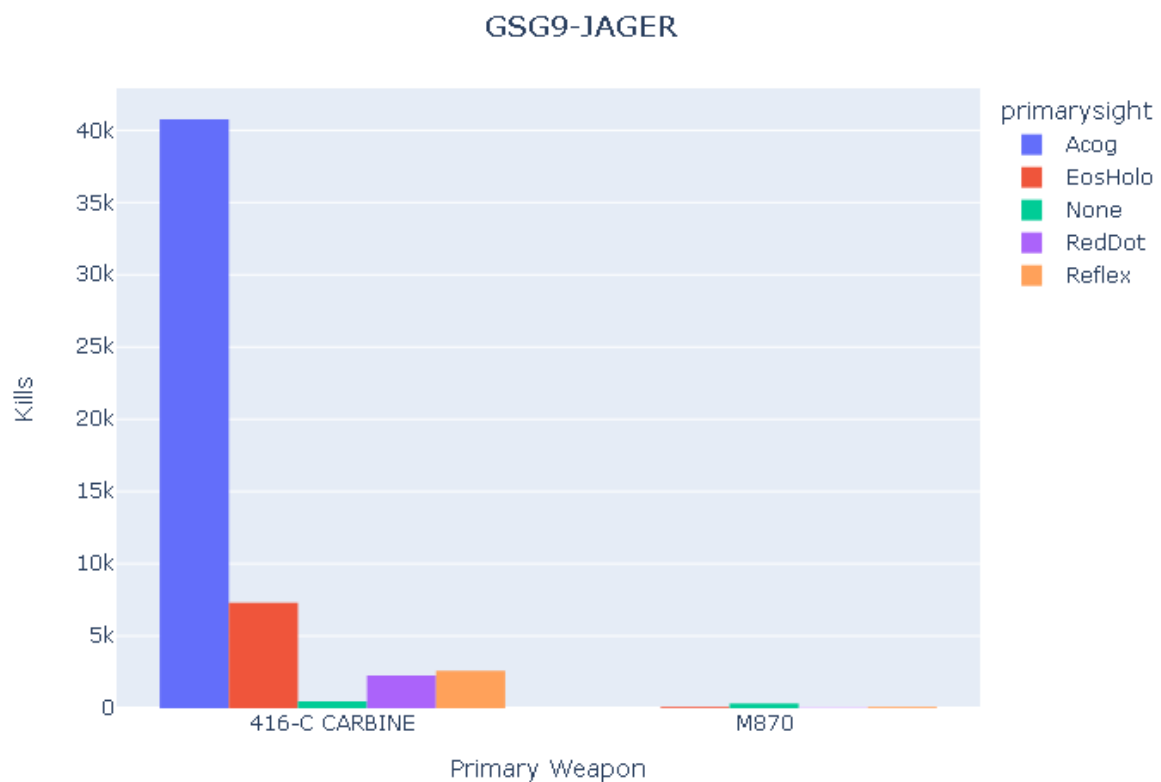
Fig 21. Primary weapon vs Kills – with primary sight (GSG9-JAGER)

In terms of kills, the 416-C CARBINE is the most effective main weapon. Figure 21 demonstrates that Acog is the best major sight related to 416-C CARBINE since it has the most kills. Let's limit ourselves to the primary weapon 416-C CARBINE and the best primary sight Acog for the rest of the investigation.

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GSG9-JAGER
Primary weapon - 416-C CARBINE, Primary sight - Acog

Fig 22. Primary grip vs Kills – with primary under barrel (GSG9-JAGER)

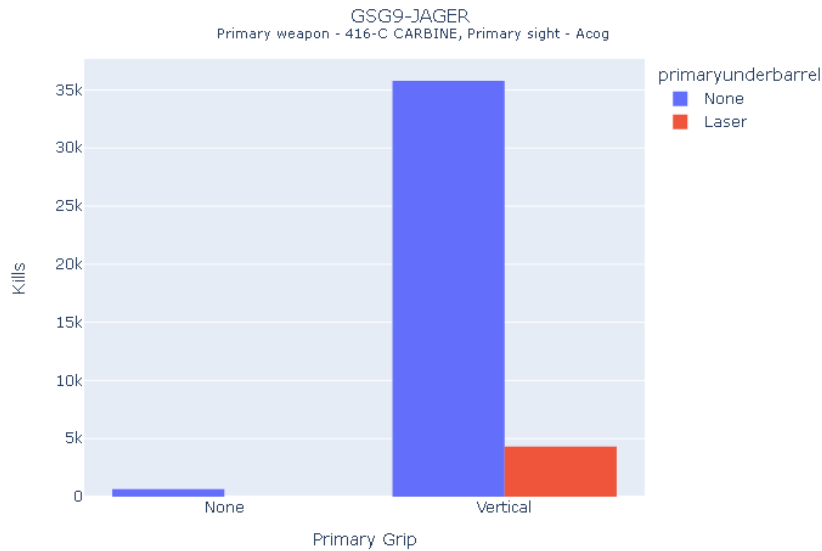After filtering the data with just 416-C CARBINE and Acog, the best grip for the primary weapon is "vertical," while the under barrel with the most kills is "None." The kill rate is high when the primary weapon is not equipped with an underbarrel. Let us now examine the data with the primary weapon set to 416-C CARBINE, the sight to Acog, the grip to vertical, and the under barrel set to "none."

GSG9-JAGER
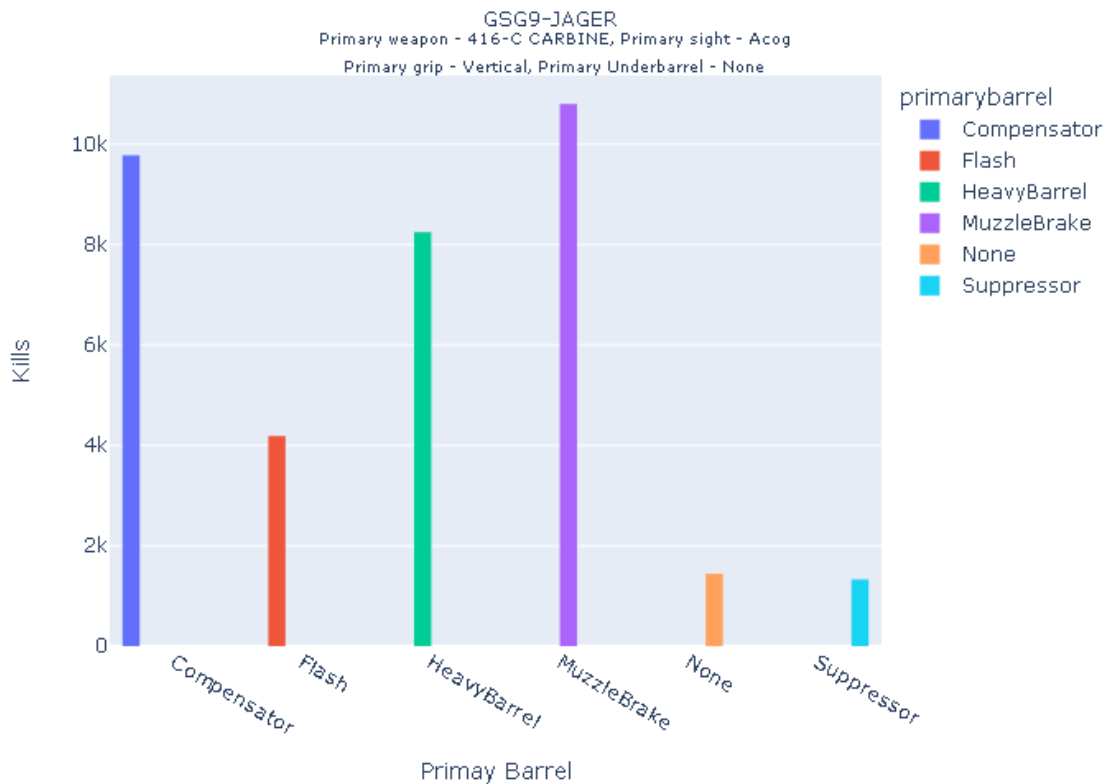Primary weapon - 416-C CARBINE, Primary sight - Acog
Primary grip - Vertical, Primary Underbarrel - None

Fig 23. Primary barrel vs Kills (GSG9-JAGER)

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The Muzzle Brake is the best primary barrel for the selected weapons combination, with the most kills, as seen in the graph above. The compensator comes in second after the Muzzle Brake.

The operator GSG9-JAGER's ideal primary weapon combination is as follows, based on the stats:

Primary weapon – 416-C CARBINE

Primary Sight – Acog

Primary Grip – Vertical

Primary under barrel – None

Primary Barrel – Muzzle Brake

Operator 4 – NAVYSEAL-VALKYRIE

NAVYSEAL-VALKYRIE is the second-best performing operator among defender operators. This operator has two primary weapons – MPX and SPAS-12. MPX is a submachine gun while SPAS-12 is a shogun.
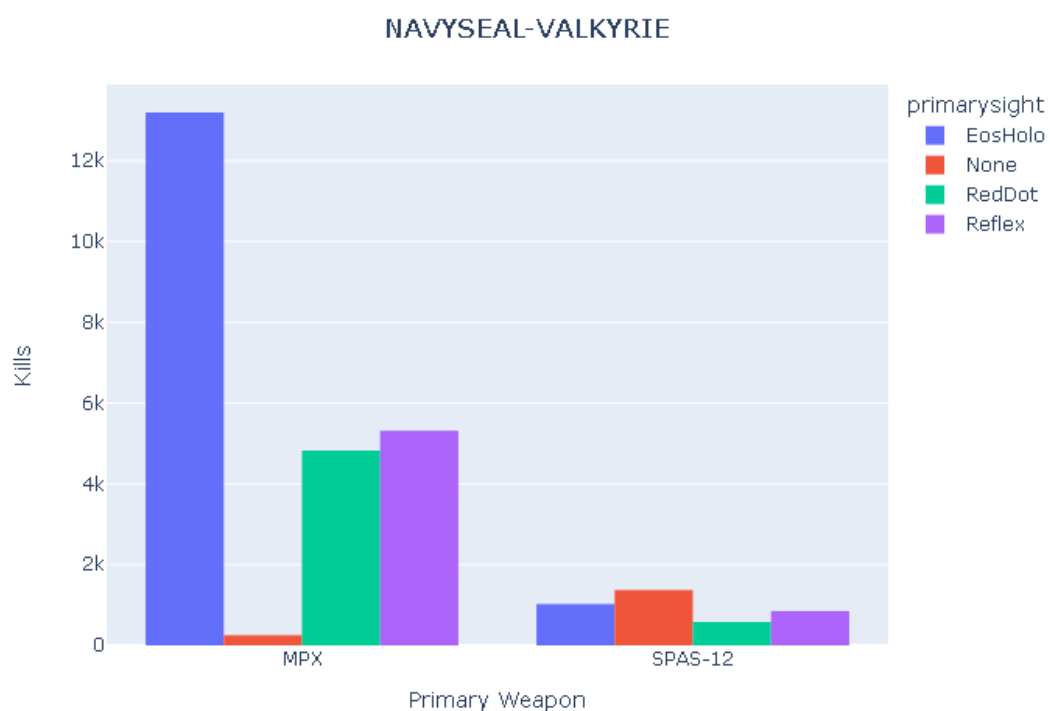
Fig 24. Primary weapon vs Kills – with primary sight (NAVYSEAL-VALKYRIE)

From figure 24, it can be observed that the weapon MPX has higher number of kills. The primary sight attached to those primary weapons are Eos Holo, Reddot and Reflex. Among them, the better performing one is the EosHolo. It has the higher kill number. Let us filter the data with MPX and EosHolo for futher analysis.

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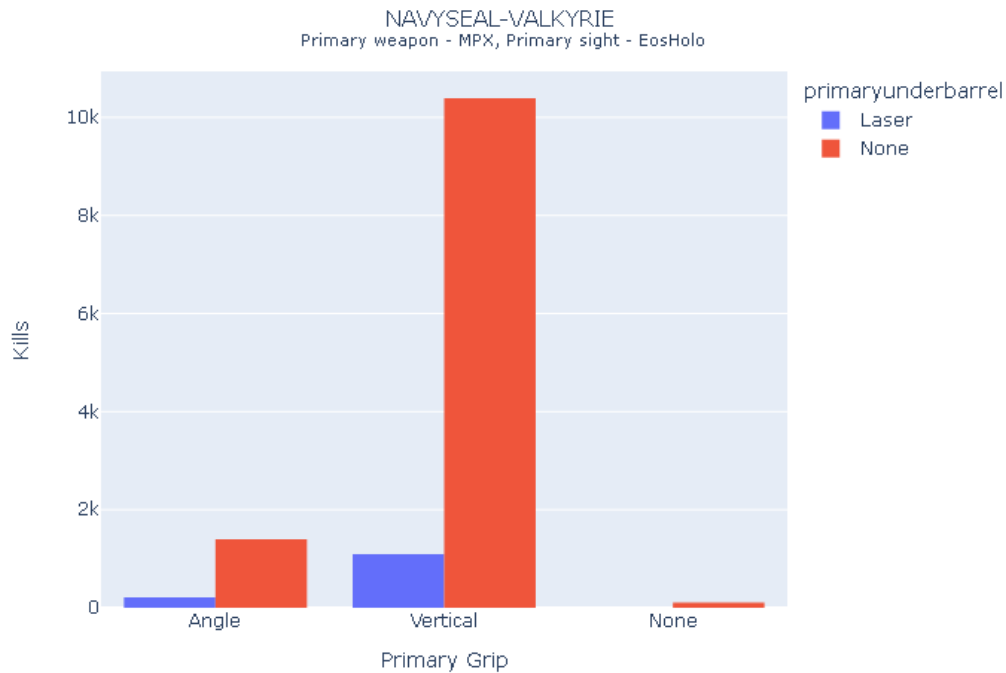
Fig 25. Primary grip vs Kills – with primary under barrel (NAVYSEAL-VALKYRIE)

The primary grip and under barrel show similar results for NAVYSEAL-VALKYRIE too when compared to all the above analysed operators and their weapons. The grip with the most kills is vertical and with no under barrels selected.

Fig 26. Primary barrel vs Kills (NAVYSEAL-VALKYRIE)

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Compared to the weaponry of the other three operators, the primary barrel which performs better here is compensator. Muzzle brake comes second. So NAVYSEAL-VALKYRIE's weaponry display a different character.

The operator NAVYSEAL-VALKYRIE's ideal primary weapon combination is as follows:
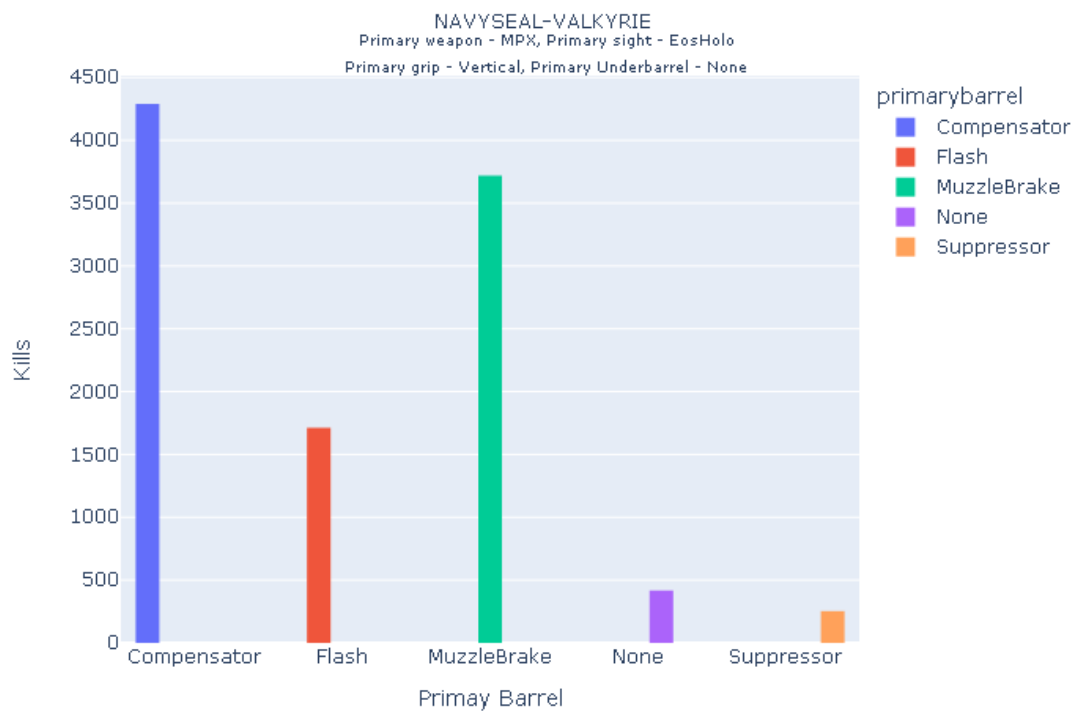
Primary weapon – MPX

Primary Sight – EosHolo

Primary Grip – Vertical

Primary under barrel – None

Primary Barrel – Compensator

Consolidated table of all the operators and their best performing weapons:

	Role	Operator	PrimaryWeapon	Primaryweapontype	Primarysight	Primarygrip	PrimaryUnderBarrel	PrimaryBarrel	nbkills
0	Attacker	BOPE-CAPITAO	PARA-308	Assault Rifles	Acog	Vertical	None	MuzzleBrake	1944
1	Attacker	G.E.O.-JACKAL	C7E	Assault Rifles	Acog	Vertical	None	MuzzleBrake	7654
2	Attacker	GIGN-MONTAGNE	Shield	Shield	None	None	None	None	6243
3	Attacker	GIGN-RESERVE	F2	Assault Rifles	Spectator	Spectator	Spectator	Spectator	231
4	Attacker	GIGN-TWITCH	F2	Assault Rifles	Acog	Vertical	None	MuzzleBrake	10106
5	Attacker	GSG9-BLITZ	Shield	Shield	None	None	None	None	2606
6	Attacker	GSG9-IQ	552 COMMANDO	Assault Rifles	Acog	Vertical	None	MuzzleBrake	1037
7	Attacker	GSG9-RESERVE	M870	Shotguns	Spectator	Spectator	Spectator	Spectator	923
8	Attacker	JTF2-BUCK	CAMRS	Marksman Rifles	Acog	None	None	MuzzleBrake	2365
9	Attacker	NAVYSEAL-BLACKBEARD	MK17 CQB	Assault Rifles	Acog	Vertical	None	MuzzleBrake	1749
10	Defender	SAS-RESERVE	MP5K	Submachine Guns	Spectator	Spectator	Spectator	Spectator	555
11	Attacker	SAS-SLEDGE	L85A2	Assault Rifles	Acog	Vertical	None	MuzzleBrake	5417
12	Attacker	SAS-THATCHER	L85A2	Assault Rifles	Acog	Vertical	None	MuzzleBrake	3010
13	Attacker	SAT-HIBANA	TYPE-89	Assault Rifles	Acog	Vertical	None	MuzzleBrake	11949
14	Attacker	SPETSNAZ-FUZE	AK-12	Assault Rifles	Acog	Vertical	None	Compensator	2773
15	Attacker	SPETSNAZ-GLAZ	OTs-03	Marksman Rifles	Reflex	None	None	MuzzleBrake	2268

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16	Attacker	SPETSNAZ-RESERVE	AK-12	Assault Rifles	Spectator	Spectator	Spectator	Spectator	225
17	Attacker	SWAT-ASH	R4-C	Assault Rifles	Acog	Vertical	None	MuzzleBrake	6744
18	Attacker	SWAT-RESERVE	R4-C	Assault Rifles	Spectator	Spectator	Spectator	Spectator	314
19	Attacker	SWAT-THERMITE	556XI	Assault Rifles	Acog	Vertical	None	MuzzleBrake	6588
20	Defender	BOPE-CAVEIRA	M12	Submachine Guns	Reflex	None	None	HeavyBarrel	3604
21	Defender	G.E.O.-MIRA	VECTOR .45 ACP	Submachine Guns	EosHolo	Vertical	None	Compensator	6510
22	Defender	GIGN-DOC	MP5	Submachine Guns	Acog	Vertical	None	MuzzleBrake	3971
23	Defender	GIGN-ROOK	MP5	Submachine Guns	Acog	Vertical	None	Flash	6013
24	Defender	GSG9-BANDIT	MP7	Submachine Guns	Acog	None	None	Compensator	8397
25	Defender	GSG9-JAGER	416-C CARBINE	Assault Rifles	Acog	Vertical	None	MuzzleBrake	10799
26	Defender	JTF2-FROST	9mm C1	Submachine Guns	RedDot	Angle	None	HeavyBarrel	6252
27	Defender	NAVYSEAL-VALKYRIE	MPX	Submachine Guns	EosHolo	Vertical	None	Compensator	4290
28	Defender	SAS-MUTE	MP5K	Submachine Guns	EosHolo	None	None	Compensator	2564
29	Defender	SAS-SMOKE	FMG-9	Submachine Guns	Reflex	None	None	Flash	2051
30	Defender	SAT-ECHO	MP5SD	Submachine Guns	Acog	Vertical	None	None	3266
31	Defender	SPETSNAZ-KAPKAN	9x19VSN	Submachine Guns	Reflex	Vertical	None	Compensator	1925
32	Defender	SPETSNAZ-TACHANKA	9x19VSN	Submachine Guns	None	None	None	None	222
33	Defender	SWAT-CASTLE	UMP45	Submachine Guns	EosHolo	Vertical	None	HeavyBarrel	1020
34	Defender	SWAT-PULSE	UMP45	Submachine Guns	EosHolo	Vertical	None	HeavyBarrel	1592

Table 2. operators and their best performing weapons

Question 3:

There might be a key factor for each round's victory. It's possible that the assailants were able to disarm the explosives or eliminate all of the opponents. We want to find the best reasons to win on each map. The purpose of this study is to instruct players on how to select the optimum win condition. For example, in the bomb game mode, it may be more successful to go for the kill rather than try to disperse the bomb first for a certain level, maybe owing to map design. We're attempting to figure out if the victory condition and the map are linked.

For the analysis of this problem, let us divide the data according to the game modes – Bomb, hostage and secure area game modes. We will be analysing the data for these three game modes separately. The need for the analysis to be done separately is because, for each game mode, the reason for the round win is different. Some of the common round winning reasons are attackers eliminated, defenders eliminated, attackers surrendered, defenders surrendered, all teams dead etc. For the bomb game mode, the round winning reasons, other than the reasons mentioned before, are bomb exploded, defuser deactivated, and bomb deactivated. As for the hostage game mode attackers killed hostage, time expired, hostage extracted, and defenders killed hostage are other reasons. Objective protected and objective captured are other round winning reasons for the secure area game mode. Let us now dive deep into the analysis of each of these game modes.

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The BOMB game mode is the game mode in R6 where the defenders plant bombs at different sites. The objective location defers with each map. The job of the attacker is to find and defuse the bomb before the bomb explodes or kill all the defenders before they plant the bomb. Let us find out what are the main reasons for both attackers and defenders to win a round with respect to each map and bomb game mode.
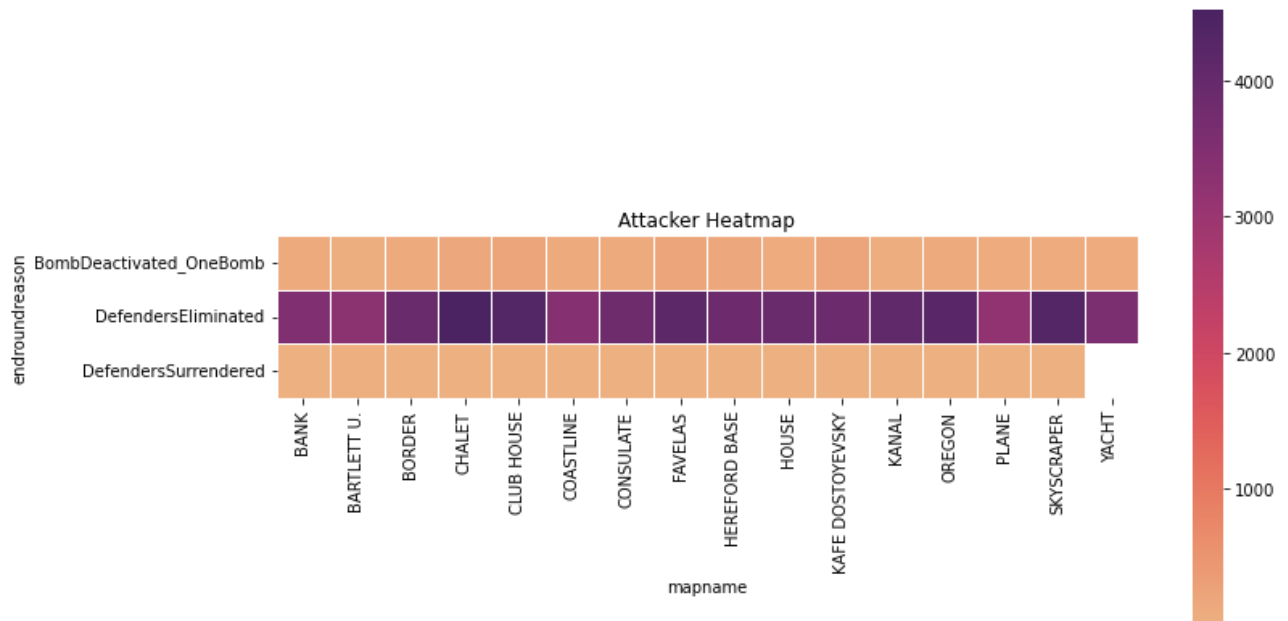

Fig 27. Attacker heatmap – Bomb game mode

Figure 27 represents a heatmap with map names on X axis and different round win reasons on Y axis. The number of round wins is shown in each of the cells.

It is clear from the heatmap that for the attackers to win the round, it is best to eliminate the defenders before they plant the bomb. Let us now analyse for the defender role.
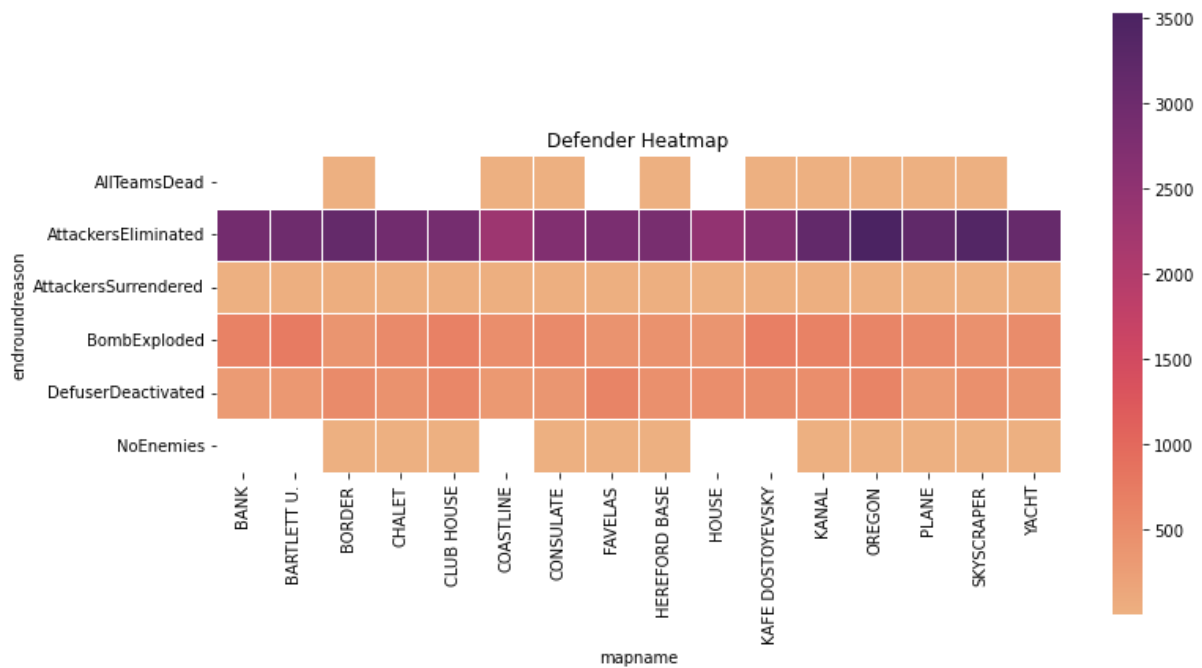
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Fig 28. Defender heatmap – Bomb game mode

There are so many missing values in "all teams dead" and "No enemies" in some of the maps. So, there is a need to remove these two reasons for a better analysis. Below shows the optimized plot.
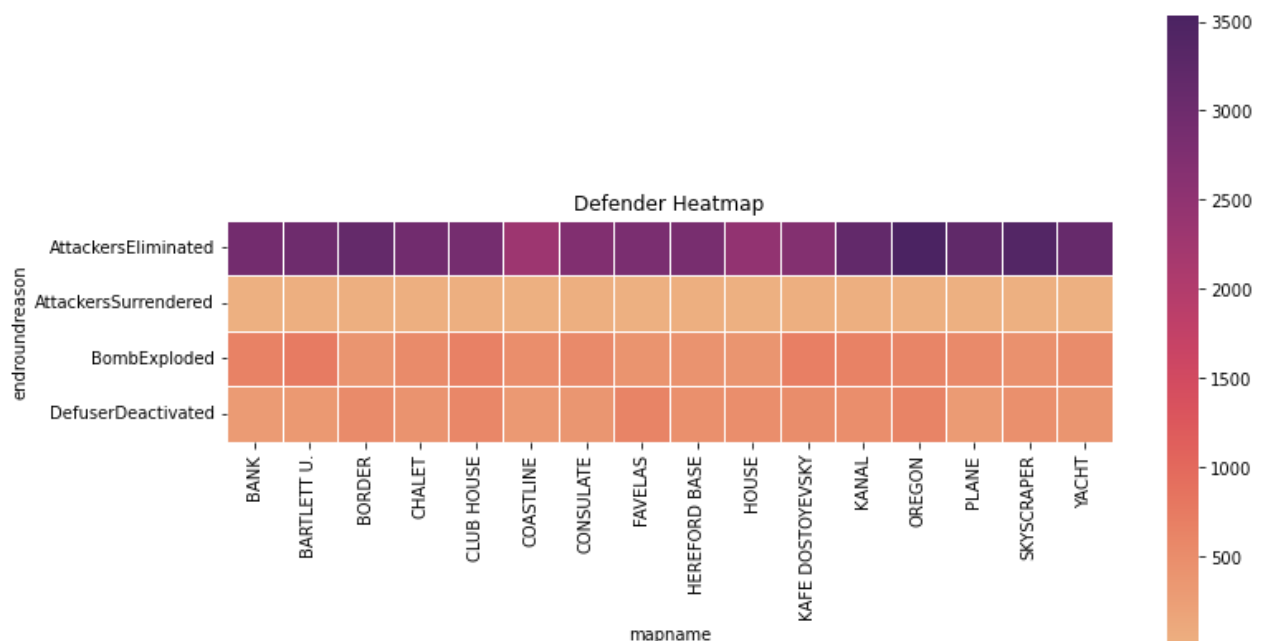

Fig 29. Defender heatmap – Bomb game mode

Figure 29 represents the heatmap after eliminating the missing values. It is clear from the heatmap that the best round winning reason for the defender role is attackers eliminated. That means, it is best for the defenders to kill every single attacker to improve their chance of winning the game. The overall heatmap of both attackers and defenders is plotted below.

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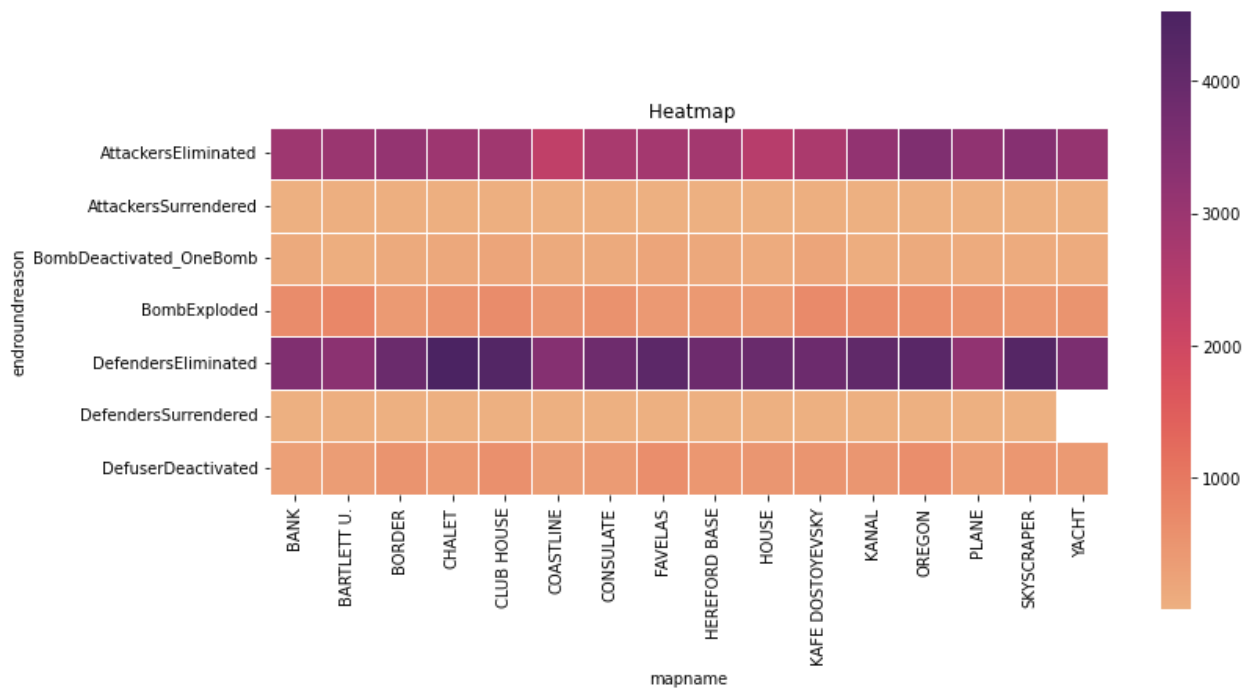
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Fig 30. Overall heatmap – Bomb game mode

From the above heatmap, it is evident that the best round winning reasons are attackers getting eliminated and defenders getting eliminated. Further down the analysis, these two reasons seem to be the most common winning reasons for both hostage and secure area game modes. This will be proved through visualizations in the coming sessions. Now, let us remove these two main winning reasons for analysing what are the other major round winning reasons in the bomb game mode.
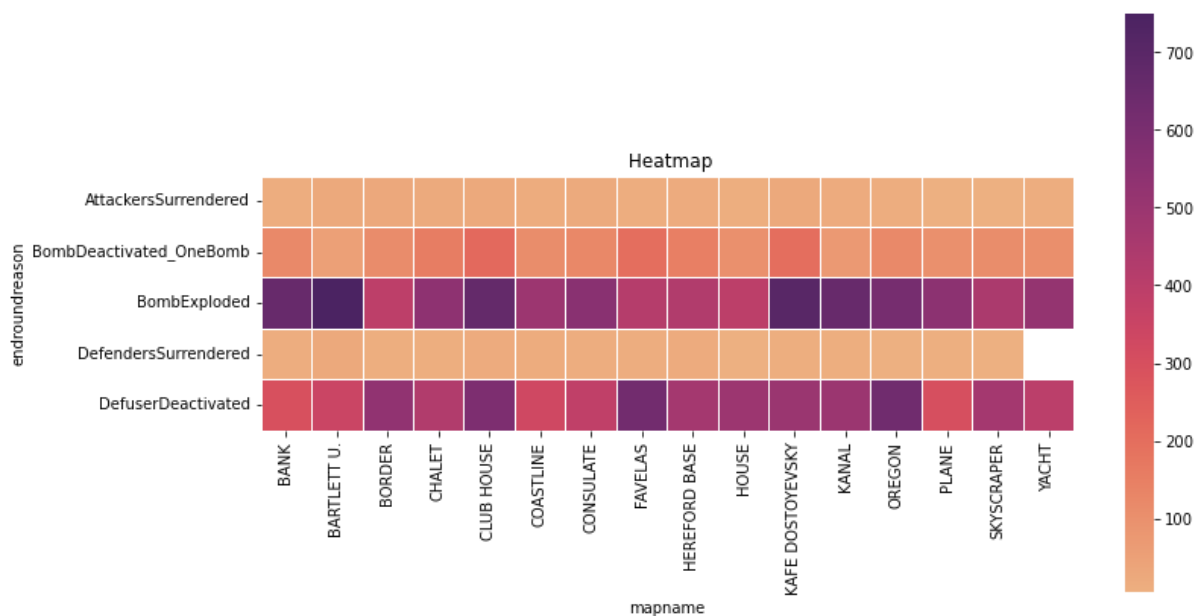

Fig 31. Overall heatmap without attackers and defenders eliminated reason – Bomb game mode

Figure 31 shows the heatmap without the winning reasons - attackers getting eliminated and defenders getting eliminated. It is clear that the next best reasons for the defenders to win are bomb exploding and defuser deactivated. This means there is an unfair advantage for defenders compared

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to attackers in the bomb game mode. Some of the maps such as BANK, BARTLETT U, CLUB HOUSE, KANAL, and KAFE DOSTOYEVSKY have higher chance of winning just by bomb exploding. So, if the players select an attacker operator to play a bomb defusing operation, it is preferable to go straight for the kill because the chances of winning by defusing the bomb are rather low. If you choose a defensive operator, you may have a better chance of winning in the bomb game mode. You have the option of going for the kill directly or winning the round by placing the bomb or deactivating the defuser. This study can also provide useful information to developers. In the bomb game mode, they may change the map designs to make it fair for both attackers and defenders. Alternatively, because defenders have an edge over attackers in terms of round winning reasons, they might develop attackers stronger especially for this game format.

Game mode – HOSTAGE

Hostage mode is the mode where the defenders keep some people as hostages and the attackers try to rescue the hostages before the time expires. Neither defenders nor attackers should kill the hostages. If they do, the ones who killed the hostages will lose the round. Let us now analyse the best round winning reasons for both attackers and defenders in the hostage game mode.
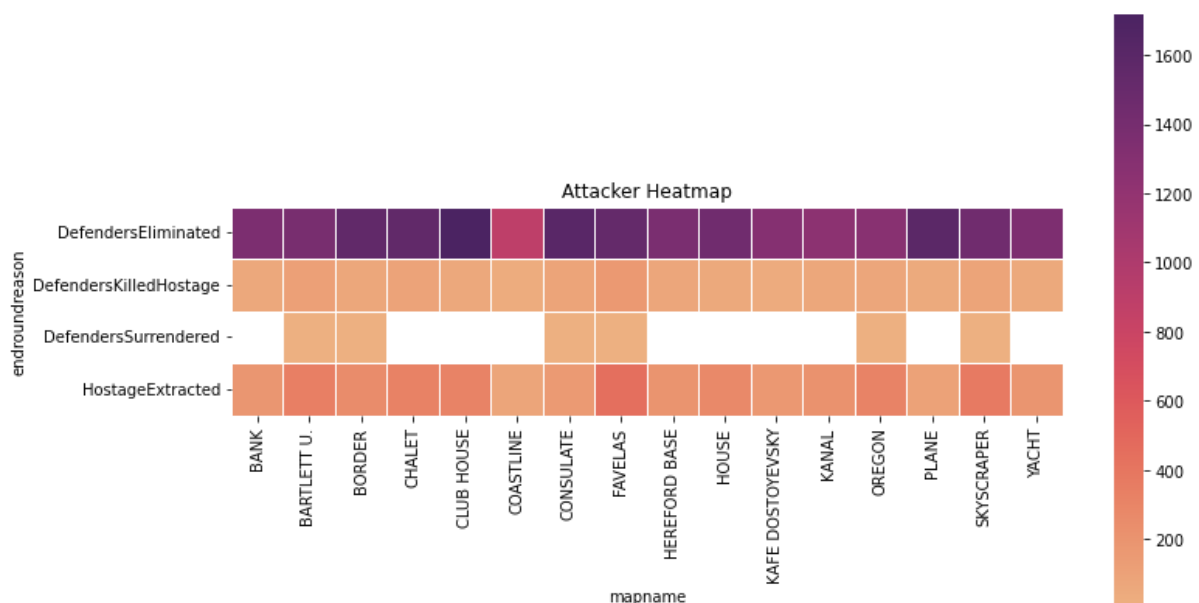

Fig 32. Attacker heatmap – Hostage game mode

Figure 32 represents the heatmap of the hostage game mode for attackers. The heatmap is drawn for the rounds the attackers won with respect to maps and round winning reasons. It is evident from the plot that the round winning reason "Defenders surrendered" has missing values. So let us remove that category and plot the heatmap again.

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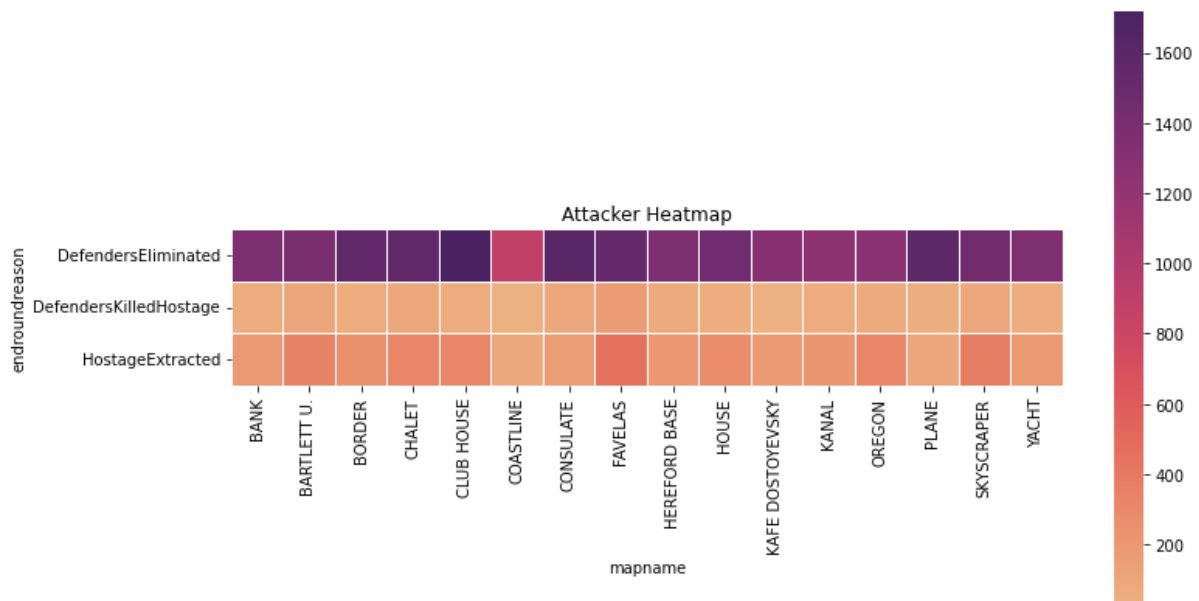bs330@student.le.ac.uk

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Fig 33. Attackers heatmap – Hostage game mode

It is clear from figure 33 that the man reason for attackers to win the round is defenders getting eliminated. The other two reasons tend to have a lower winning rate for attackers. Let us now analyse for the defenders.
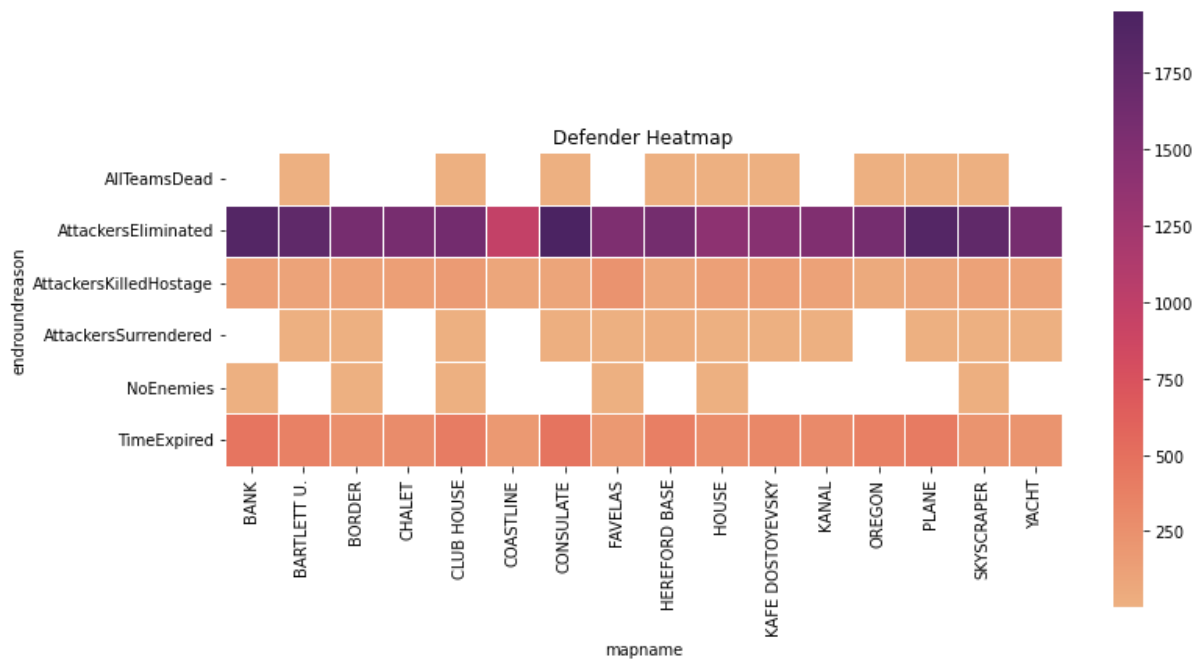

Fig 34. Defender heatmap – Hostage game mode

For defenders too, there are missing values in some of the round winning reasons. Let us remove these end round reasons and continue analysing.

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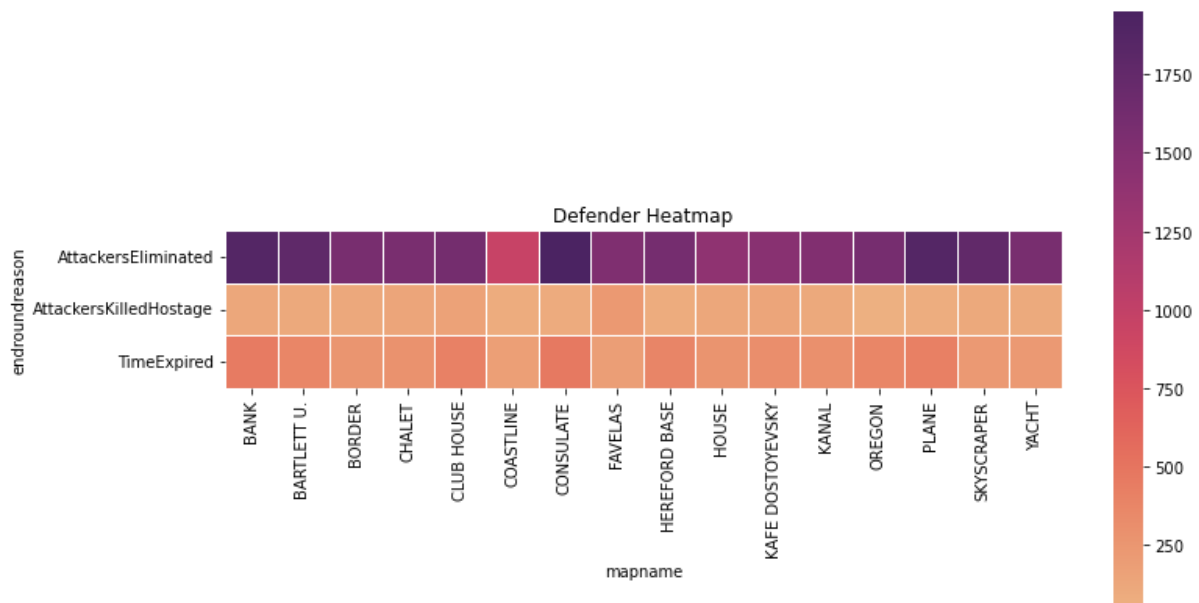bs330@student.le.ac.uk

Fig 35. Defender heatmap – Hostage game mode

For the hostage game mode, the best winning reason for the defenders is all the attackers getting eliminated. We have seen the same pattern in bomb game mode too. It will be unfair if we did not check for the next best round winning reasons. So, let us continue to analyse further.
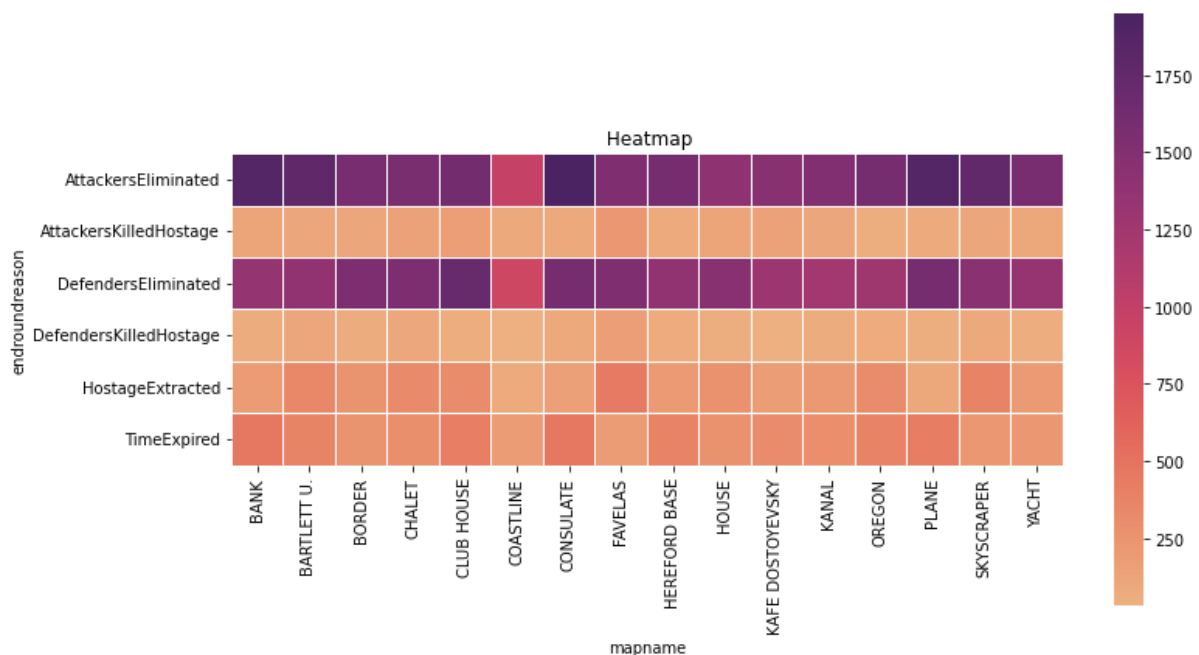

Fig 36. Overall heatmap – Hostage game mode.

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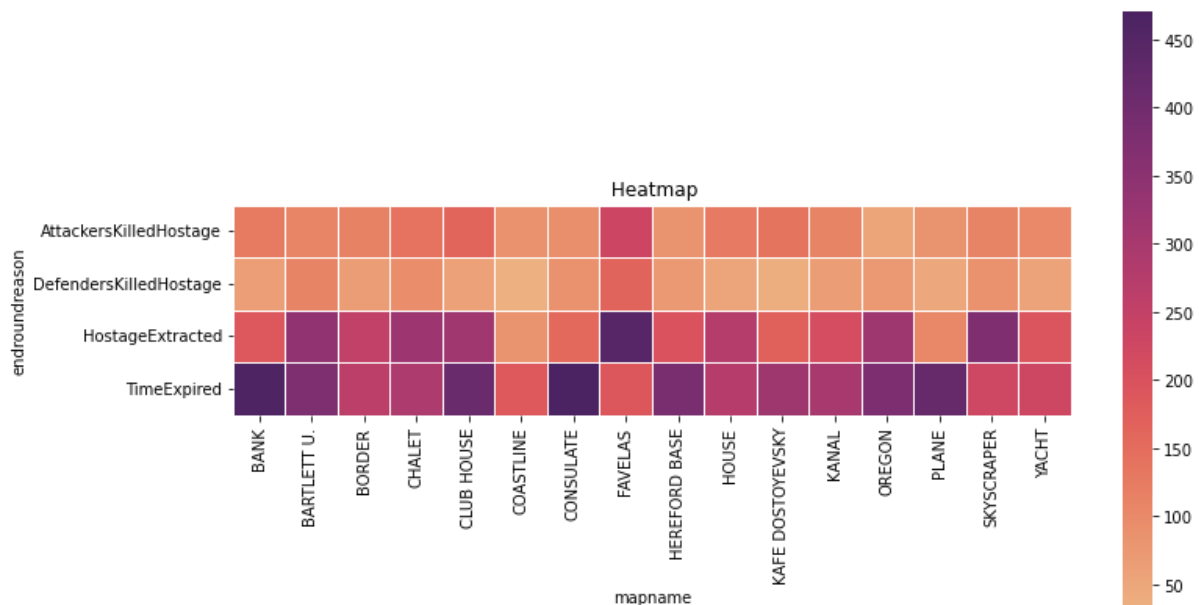bs330@student.le.ac.uk

Fig 37. Overall heatmap without attackers and defenders eliminated reason – Hostage game mode

Figure 37 shows the heatmap without the winning reasons - attackers getting eliminated and defenders getting eliminated. It is evident from the above heatmap that the next best reasons for winning the rounds are hostage getting extracted and time expiring. Hostage extracted is an attacker winning reason and time expiring is a defender winning reason. So, it is fair to say that hostage game mode is fairly designed than the bomb game mode. When we analyse further, it is clear that the maps BANK, CLUB HOUSE, CONSULATE, HEREFORD BASE, and PLANE tend to be biased towards defenders. Whereas FAVELAS and SKYSCRAPPER maps tend to support attackers more in the case of hostage game mode. Also, there is a higher chance of attackers killing hostages in the FAVELAS map.

Game mode 3 – Secure area

Teams must race to a specific region in the Secure Area multiplayer game mode to secure a site that holds a biohazard container. Players only have one life; therefore, a team may win a round by removing all of the other team's players. It's not only the biohazard container that has to be protected; the entire space containing hazardous things must be guarded. Because there is not a specific item that has to be grabbed or destroyed, secure area is more analogous to team deathmatch. Players on both sides must eliminate the opponents in order to secure the target room. (Bell, 2015)

Let us analyse the best round winning reasons for attackers in the secure area game mode.

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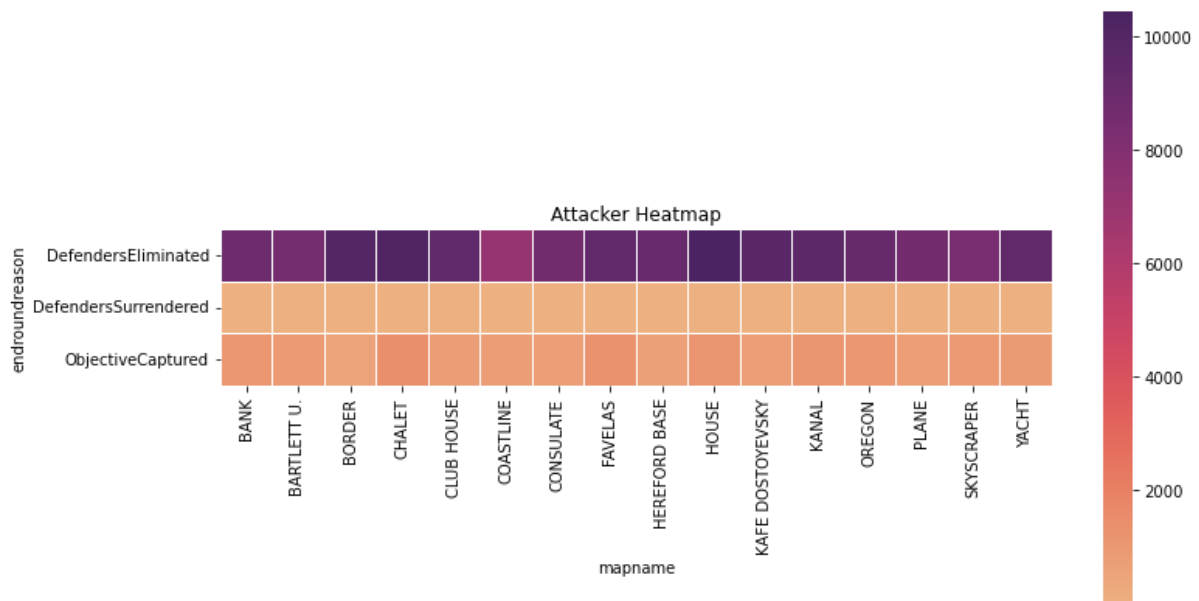bs330@student.le.ac.uk

Fig 38. Attackers heatmap – Secure Area game mode

As the heatmap shows above, the best round winning reason for the attacker role is eliminating all the defenders. The game mode itself is designed to instigate killing more than winning the round through other reasons. So this round winning reason is miles ahead of other reasons.

Let us now analyse the secure area game mode for defenders.
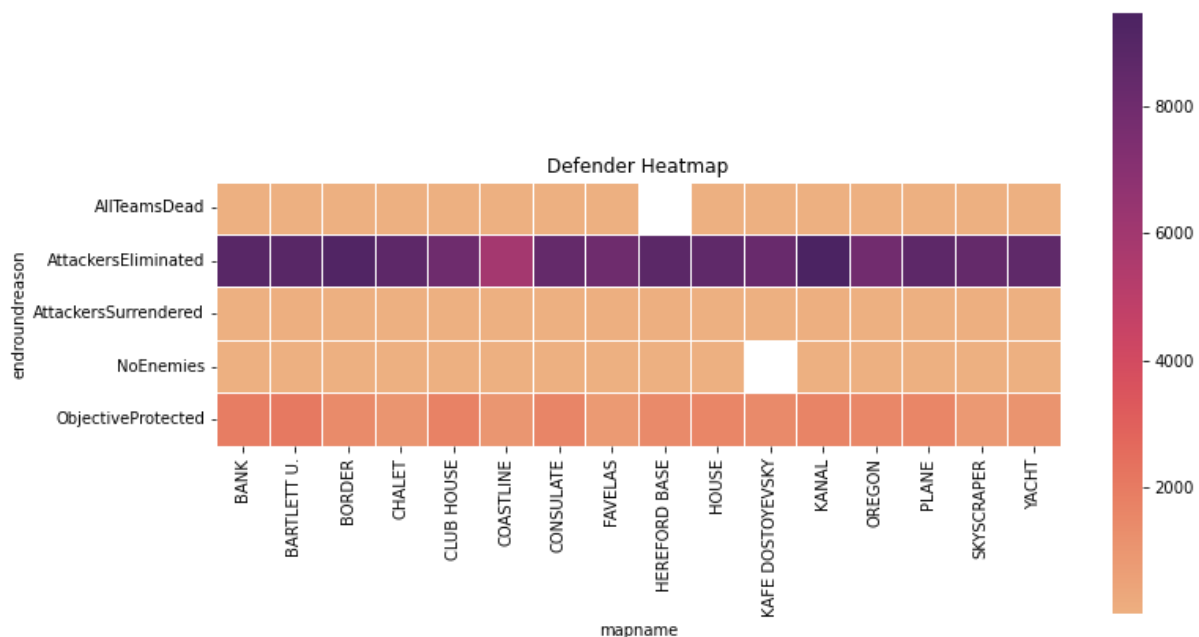
Fig 39. Defenders heatmap – Secure area game mode

Again, for the defender role too, the best round winning reason is eliminating all the attackers. But protecting the objective seems to have a slightly higher win rate compared to all other round winning reasons apart from "AttackersEliminated". So, let us analyse further for both attackers and defenders combined.

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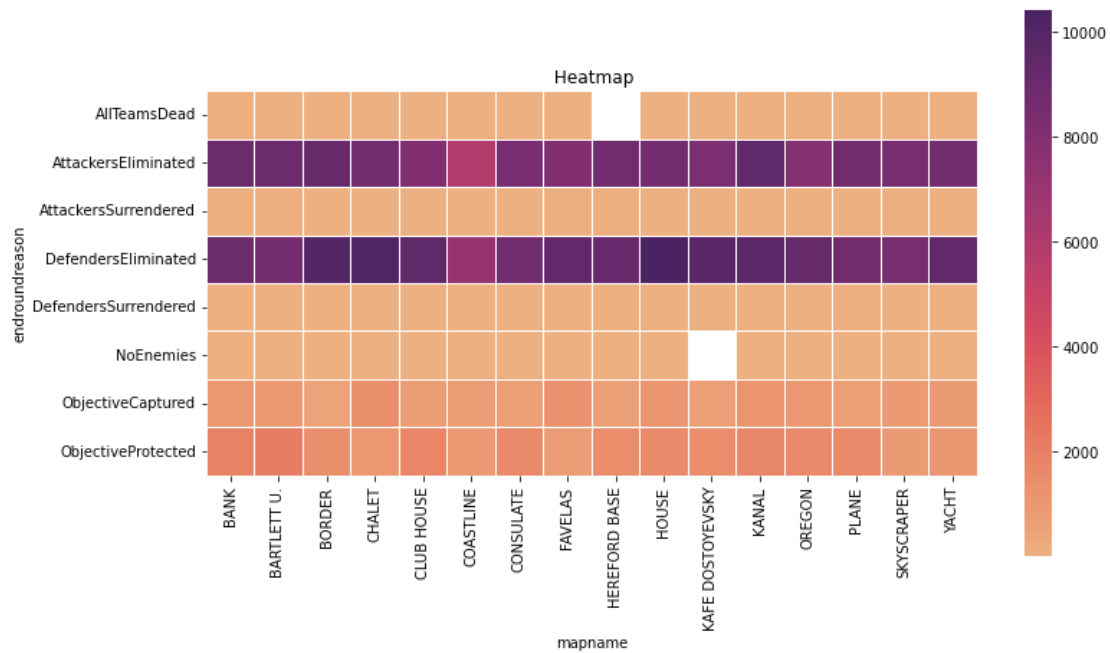
Fig 40. Overall heatmap – Secure area game mode.
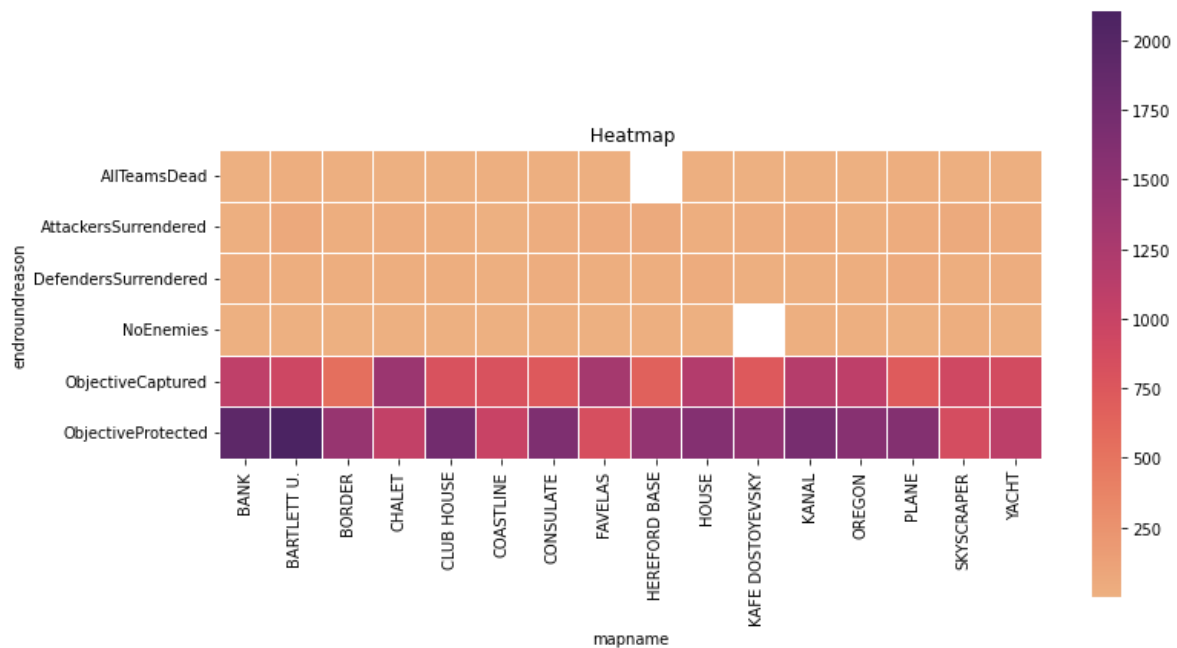
Fig 41. Overall heatmap without attackers and defenders eliminated reason – Secure area mode

From figure 41, we get a clear picture of what are the secondary reasons for the round win. For the attackers, capturing the object is the next best round winning reason as for defenders, it is protecting the objective. But the defenders seem to have an edge over attackers in secure area game mode too. Let us summarize the wins for the reasons objective captured and objective protected into a table.

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endroundreason mapname	ObjectiveCaptured(Attacker win)	ObjectiveProtected(Defender win)
BANK	1081	1931
BARTLETT U.	943	2103
BORDER	545	1426
CHALET	1394	1051
CLUB HOUSE	811	1751
COASTLINE	811	1002
CONSULATE	732	1644
FAVELAS	1299	840
HEREFORD BASE	663	1469
HOUSE	1177	1594
KAFE DOSTOYEVSKY	732	1473
KANAL	1165	1701
OREGON	1087	1569
PLANE	716	1606
SKYSCRAPER	927	858
YACHT	882	1107

Table 3. round ending reason for all maps (Objective captured and protected)

It is evident from the above table that defender tend to win more when the secondary winning reasons are compared. Thus, proving that defenders have an edge over attackers in the secure area game mode, especially in some maps such as BANK, BARLETT U, BORDER, CLUBHOUSE, CONSULATE, HEREFORD BASE, KAFE DOSTOYEVSKY, KANAL, and PLANE.

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CONCLUSION

The Rainbow Six Siege: Exploratory data analysis project helped in answering all of the proposed questions. There are multiple extra ordinary operators in both attacker and defender roles. SWAT-ASH and NAVYSEAL-BLACKBEARD are the best two operators in the attacker role. SWAT-ASH topped in eight maps while NAVYSEAL-BLACKBEARD topped in six other maps. They both have topped in 14 of the 16 maps in R6 "Operation Velvet Series" for the attacker role. For the defender role, GSG9-JAGER and NAVYSEAL-VALKYRIE are the best two operators. GSG9-JAGER topped in 13 maps out of 16 and he is the undisputed killing machine as far as the defender operators are concerned. GSG9-JAGER proves to be an operator who is incomparably better than the other defender operators as far as the kill ratio is concerned. This might be due to the operator's design and the weapons he uses in the game. The developers can look into the design of the operator to make it equal among other operators.

As for the second question, which is the best primary accessories for the primary weapon, the analysis was done on the best 4 operators. For SWAT-ASH the best primary weapon and the best accessories for it are Primary weapon – R4-C, Primary Sight – Acog, Primary Grip – Vertical, Primary under barrel – None and Primary Barrel – Muzzle Brake. For NAVYSEAL-BLACKBEARD; Primary weapon – MK17 CQB, Primary Sight – Acog, Primary Grip – Vertical, Primary under barrel – None, and Primary Barrel – Muzzle Brake. For GSG9-JAGER; Primary weapon – 416-C CARBINE, Primary Sight – Acog, Primary Grip – Vertical, Primary under barrel – None, and Primary Barrel – Muzzle Brake. For NAVYSEAL-VALKYRIE; Primary weapon – MPX, Primary Sight – EosHolo, Primary Grip – Vertical, Primary under barrel – None, and Primary Barrel – Compensator.

The best round winning reasons for both attackers and defenders in the three game modes were found out. The best reason for the attackers to win a round is to kill every defender and for the defenders, it is to kill every attacker. This reason was obvious, so there was a need to dig deep to find out other major reasons for the win. It was found that other best reasons for the defenders to win a round in bomb mode were bomb exploding and deactivating defuser. The attackers tend to have no other major round winning reason other than killing every defender in the bomb game mode. Thus, proving that defender teams have an unfair advantage over attackers in the bomb game mode.

In the hostage mode, both defenders and attackers have an equal chance of winning the round. The defenders usually win the round by killing all of the attackers or when the round timer runs out. In contrast, attackers win the round by killing the defenders or extracting all of the captives. The data shows that the secondary causes, removing hostages and time running out, have almost identical chances of success. As a result, we cannot verify that the hostage game style favours a specific team role.

In terms of supplementary winning reasons, defenders tend to have an advantage over attackers in the secure area game mode. The two major secondary winning reasons for attackers and defenders, respectively, are the objective captured and the objective protected. According to the research, the majority of maps favoured defenders in preventing the objective or biohazard from being acquired by the attackers. As a result, it was clear that the secure area game mode favoured defence teams more.

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This data analysis initiative is beneficial to both users and game creators in a variety of ways. The greatest operators can be chosen by the players to boost their chances of killing more and winning the round. Only killing ratio was used to select the best operators. As a result, we cannot guarantee that the operator will be the greatest at winning a specific round. However, the greatest operators discovered by this study will be lethal and will undoubtedly assist the gamer in killing more opponents. To boost their chances of killing more, players can select the best primary weapon and accessories for their weapon. As for the developers, they may study the top operators and improve other operators, or they can change the design of the top operators to improve the gameplay for everyone. Both game players and creators can look into the best round winning reasons and take insights from it. The players can choose which style they want to play for a specific game mode. Whereas developers can change the map's design or objectives to make it fair for both attacker and defensive sides.

SELF REFLECTION

As a gamer who has been playing since childhood, I was excited to work on this project. Despite having played various shooting games such as Call of Duty, Battlefield, and the Splinter Cell series, I had never played Rainbow Six Siege. As a result, it was difficult for me to comprehend the game and its parallels before diving into the game's analysis. The R6 game is comparable to Counter-Strike, which I had previously played, and this helped me comprehend R6 much faster. My team, which also included two other individuals, collaborated on several occasions, and I was happy to work with them. We attended multiple sessions during the semester to learn how to extract data, clean data, and analyse data using various tools and visualisations. I am pleased with the job I have completed for this assignment. However, if I had to perform this research again, I would extract the data for the most recent R6 game. If I accomplish this, I will be able to use machine learning and other prediction techniques to forecast the best operators, primary weapons, and accessories in the future. Machine learning and prediction will be ineffective for this project since the "Operation Velvet Shell" R6 game is from year 2 season 1. Ubisoft has gone a long way, and the R6 game is now in its seventh year. But I'm proud of myself for devoting so much time and energy to this endeavour.

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APPENDIX

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