Journal of Physics Special Topics
An undergraduate physics journal

A4_8 Call of Duty: Weltkino der Toten

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December 12, 2019

Abstract

Call of Duty: Black Ops is a famous first-person shooter war game. It is most well-known for its arcade-like game mode that centres on surviving waves of zombies for the longest amount of time possible by killing them. Zombies spawn at the beginning of each round and their numbers increase each round. In this paper, we have discovered how many rounds it would take an individual player to kill a set population of zombies through numerical analysis. We found that a player would have to survive 6408 rounds in order to kill an Earth-sized population of zombies and assessed the validity of this model through graphical methods.

Introduction

Call of Duty: Black Ops is the second game in the *Call of Duty* franchise to contain the zombie mode. Yet, it is the version to have popularised the game mode through its map and story development. A certain amount of zombies spawn in a series of determined locations on a map throughout each round - defined as a wave. The amount of zombies that spawn per round from round 1 - 100 is widely known in the gaming community and can be found on a number of gaming websites and forums such as [1]. We used this information to graph the cumulative number of zombies from round 1 - 100. Using polynomial extrapolation, we extended the graph to produce a model that predicts the total amount of zombies spawned in the game cumulatively per round. This allowed us to discover the number of rounds a player would have to survive for the total amount of spawned zombies to equal certain geographical population sizes. In this investigation, we discover the amount of rounds that correlate to the population of Leicester, the UK, Europe and the Earth.

Method

For ease and clarity, we have ignored rounds that do not include zombies (i.e Hellhounds). The data used is only relevant for one player as the number of zombies spawned per round increases with more players. Using data from source [1] that states the number of zombies spawned per round from round 1 - 100, we calculated the cumulative sum at each round. For example, at the beginning of round 3 there are 13 zombies spawned, but the cumulative total at this point is 27. We then plotted this data against the number of rounds to build the base of our model. We decided to use the third degree polynomial curve as our model, as this was the lowest order that fitted the data best, as shown in Figure 1. The second degree polynomial showed little increase in zombies over 6000 rounds and did not hold a exponential shape as we would expected. The best fit curves after the fourth degree did not hold consistent trends and

fluctuated in shape. Now that we had the model, it was possible to extract information regarding population size and rounds from the third polynomial curve and coefficients. Earth's human population as of 15:27GMT, 18/10/19 was 7737873136 [2]. Therefore the fit was extended to 8 billion zombies so to include this value, as shown in Figure 2. We discovered the number of rounds needed to model the population of Leicester, the UK, Europe and the World.

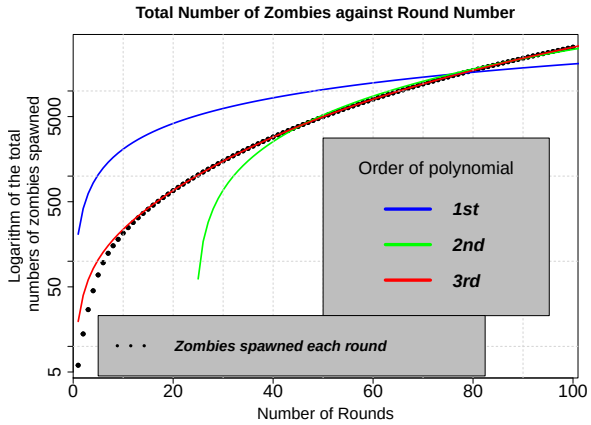

Figure 1: Effect of changing polynomial order to fit data

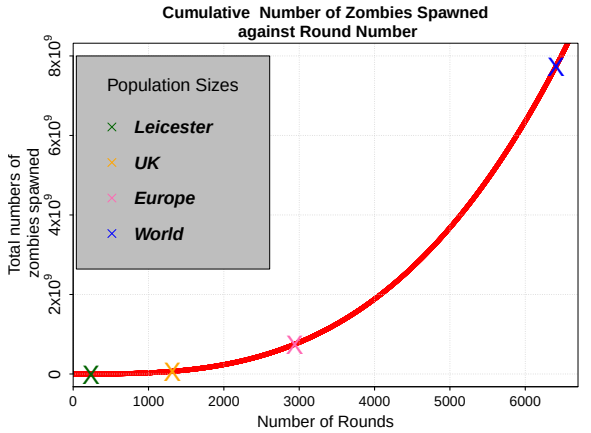

Figure 2: Cumulative number of zombies spawned in game

Results and Discussion

The total number of zombies spawned in a game has an exponential trend due to the data set as seen in Figure 2. The amount of zombies spawned per round at the higher rounds would be very large compared to earlier rounds due to this increasing gradient. Figure 2 shows that the third polynomial follows the trend of zombie population from round 1 - 100 to a greater degree of accuracy than the first and second polynomial, showing they are incorrect representations. The third order polynomial does lack accuracy at low round numbers, but tends towards the data as the round number increases. The fourth polynomial also fits the data, but not to a justifiable greater degree of accuracy, therefore using this would be over-plotting. Table 1 shows the results. As the number of zombies per round must be an integer, all of the calculated values have been rounded up. It was found that a player would need to play 6408 rounds in order for the total amount of zombies spawned to equal the world's population.

Location	Population	Round Number
Leicester	404489 [3]	238
UK	67639896 [4]	1319
Europe	747322745 [5]	2939
World	7737873136 [2]	6408

Table 1: Rounds needed to survive certain population sizes of zombies

Conclusion

By modelling certain population sizes as zombies based on the *Call of Duty: Black Ops* video game, we have shown how many rounds it would take to survive several geographical population sizes of hordes. We have discovered that an individual must survive 6408 rounds in order to survive an Earth-sized population of zombies. For a more thorough investigation, we would perform a goodness of fit test on the model in a future paper.

References

[1] `https://bit.ly/38uQQnK` [Accessed 18/10/19]

[2] `https://bit.ly/2Eb7eLW` [Accessed 15:27GMT, 18/10/19]

[3] `https://bit.ly/2sdmNjQ` [Accessed 21/10/19]

[4] `https://bit.ly/2XLzSMM` [Accessed 20:52GMT, 21/10/19]

[5] `https://bit.ly/2XMmJmB` [Accessed 20:54GMT, 21/10/19]