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Game Sophistication Analysis: case study using e-Sports Games and TETRIS

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Game is an important part of human life in this era. A lot of researches have been done to find a way to make a game more interesting and exciting. With these backgrounds "Game Informatics" has been established as a new research area in the field of information and computer science. This thesis focuses on the game refinement theory application and its development. The present contributions can be divided into two parts: An Analysis of TETRIS and Studies of Fairness Mechanism in Multiplayer Online Battle Arena Games. Chapter 2 focuses on the reason why TETRIS can be popular for so many years, whereas Chapter 3 discuss the fairness mechanism in Multiplayer Online Battle Arena Games.

Chapter 1 introduces the background of game, game theory and game refinement theory. Game theory is a fascinating subject. It solve the problem of "how to win the game". it is the mathematical method with focus on the players side. And we introduced the essential element in game theory, Nash Equilibrium and its application to Prisoner's Dilemma. Game refinement theory also plays an important role in the development of computer playing game and general games. It focuses on quantifying the engagement of players to games and based on those values, games are classified and analyzed to improve the attractiveness of the game itself.

Chapter 2 will briefly introduce the Game Refinement Measure. Then we will focus on TETRIS which is the best-selling video game and using a

personal experiment to explain the methodology to transform Tetris to a changing branching factor board game. At last we will explain the reason why TETRIS been popular for so many years. Following the approach of dynamic branching factor, we got the game refinement value of TETRIS is 0.077. But in real games the value will be much smaller than 0.077. Hence we extended to the concept of momentum in game. Because the TETRIS always give players pressure, even if the game refinement value of TETRIS is not as high as other popular games, it also gives more momentum to players. Therefore TETRIS keeps popular for many years.

Chapter 3 explores key factors to maintain fairness in e-sports like Multiplayer Online Battle Arena (MOBA) games: Dota 2, League of Legends, and Heroes of the Storm. It analyzes the degree of fairness based on the winning ratio. Moreover, it considers the evolution of MOBA games with focus on three major factors: the ban and pick system, balancing characters and maps, and compares with other games such as board games and sports games. It is found that fairness is important but not so essential in the domain of e-sports from entertainment's point of view, even though fairness is significantly important in the domain of sports and board games.

In this study we observed the fairness mechanism in MOBA games with focus on three factors: winning ratio between the different sides of a map, different orders of ban and pick, and the number of characters which appeared in the game. These three factors are equally important with scoring 100 points for each. Then we calculate the total scores for the three games.

Dota2 has 9.08% different winning rate between different order of ban and pick, it gets $100 - 9.08 = 90.92$ points. Difference between different sides of map is 21.22%, then it gets $100 - 21.22 = 78.78$ points. 76.58% of all characters appeared in the tournament games, so it gets 76.58 points. Dota2 scores $90.92 + 78.78 + 76.58 = 246.28$ points in total.

LoL has 16.66% different winning rate between different sides of map. Since the ban and pick of LoL is bound to the side of map, it gets $(100 - 16.66) \times 2 = 166.68$ points. 54.96% of all characters appeared in the tournament games, so it gets 54.96 points. LoL scores $166.68 + 54.96 = 221.64$ points in total.

HotS has 4.66% different winning rate between different order of ban and pick, it gets $100 - 4.66 = 95.34$ points. Difference between different

sides of map is 11.62%, then it gets $100 - 11.62 = 88.38$ points. 86.27% of all characters appeared in the tournament games, so it gets 86.27 points. HotS scores $95.34 + 88.38 + 86.27 = 269.99$ points in total.

Therefore, these scores proved that HotS is the fairest game among the three, whereas Dota2 is the second and LoL is the last one. But the audiences number of these games is reverse. According to Twitch which is the most famous live stream site, it shows that, LoL has $73,098$ audiences, Dota2 has $20,398$ audiences, and HotS has only $1,546$ audiences at the same time (9:41 PM, July 6, 2016, PT). The fairest one is the least popular one. This may imply that fairer games would become less popular. However, a totally (too much) unfair game obviously cannot be a competition game. Further investigation of the lower limit of fairness is needed.

Chapter 4 gives conclusion and answers research questions in this thesis. And several possible future works are suggested.From Chapter 2, we know that the game refinement value of TETRIS is not as high as other popular games. But it keeps giving psychological pressure to players all the time which means more momentum than other games. Hence TETRIS is addictive, and popular for so many years.From Chapter 3, we know that MOBA games keep fair with three main factors: maps, ban and pick system and characters. And we found that the attractiveness and fairness of MOBA games are in reverse. So we conjecture a proper fairness is needed for competition games. But too much fairness of a game may reduce the appreciation of a game.