Quantifying Engagement of Electronic Sports and Cultural Aspects on Game Market

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Game informatics is a new research area in the field of information and computer science. Except for Japan, almost all the players around the world have used the personal computer to play games. Therefore, in the future, we need to pay more attention on this new research branch. In this article, we will focus on the game refinement theory and a worldwide famous video game StarCraft II, which is a real time strategy game, to present the several research achievement.

In our thesis, the research is divided into two directions, nature science part and society science part. From Chapter 2 to Chapter 4, the nature science part that will be presented is the research of my master course in JAIST, and Chapter 5 will present the content about society problem as an independent research topic.

For the nature science part, almost the research method and idea are all based on the game refinement theory, which is created by Professor Hiroyuki Iida. Game refinement idea is a unique theory that has been supported to an proposed based on the uncertainty of game outcome. A game refinement measure was derived from the game information progress model and had been applied in the traditional board games. The present challenge is to apply the game refinement theory in the domain of various games such as RTS (StarCraft II), MOBA (DotA), crane game and score

limited game. To do so, we use StarCraft II as a testbed and introduce a concept of strategy tree in order to construct a game tree of a RTS game. Then, game refinement values are calculated and compared with other type of games. It is found that StarCraft II has a zone value of game refinement.

Starcraft II is a real-time strategy game where players have the goal to destroy their enemy by building a base and an army. Players can choose 1 out of 3 races to play with. These races are Terran, Protoss, and Zerg. The Terran is humans, the Protoss are alien humanoids with highly advanced technology, and the Zerg is a collection of assimilated creatures who use biological adaptation instead of technology. For anything that the player want to build, he needs to gather two types of resources: minerals and gas. These resources are used to construct buildings, which in turn can be used to produce units. At the start of the game, not all units and buildings are available. New construction options can be unlocked by making certain buildings. This means that some units and buildings are available at the start of the game while others become available later in the game.

In order to play the game well, the player must engage in strategy, macro-management and micro-operation. Strategy determines whether player can establish the strategic superiority. Macro-management determines the economic strength of a player. Micro-operation determines how well a player is able to locally control small groups and individual units. This includes movements and attacks that are issued by the player. In addition, we notice in the StarCraft II, the most interesting part is the opening stage, because in this time domain, strategy element is the most important element and highly similar as traditional board game. So all of the research achievements of StarCraft II in our thesis are based on the opening strategy.

In order to establish the channel between traditional board game and real time strategy game, we create a new concept which is called strategy tree. In the traditional board game, minimax tree is a decision rule used in decision theory, game theory, statistics and philosophy for minimizing the possible loss for a worst case (maximum loss) scenario. Originally formulated for two-player zero-sum game theory, covering both the cases where players take alternate moves and those where they make simultaneous moves, it has also been extended to more complex games and to general decision making in the presence of uncertainty. Since Starcraft

II is an incomplete information game, all the players do not know their opponent's condition, so they only consider about their own tree. As we know, while we want to execute a strategy, we need some premises. Taking Shogi as an example, Ibisha is the father node of Yagura. According to this idea, we can establish the strategy tree of Starcraft II and other real time strategy game. The most prominent feature of strategy tree in real time strategy game is the unbalance tree. As we know, in traditional board game, all of the rules are based on the step by step, so for each player, the branch length from strategy children nodes to their father node is always equal to one. However, in StarCraft II or other real time strategy game, the depth is defined by steps process, we notice that the children node may have different depth from their father nodes. Therefore, we consider one method to solve it, that is to change the unbalance depth tree into the balance tree, then lead a new concept temporary node to solve the model and then analyze the game refinement value of StarCraft II.

Later, this thesis makes contribution to apply game refinement theory in these new areas and supports the effectiveness of game refinement theory. For the crane game application, experiments have been conducted by observing games of players in two countries: Japan and Thailand. The results show that Japanese crane games are more engaging. We will discuss some key factors in respect of types of machines and also the emotional impact. For the DotA application, we evaluate the measurement for different versions of DotA. The results of game refinement value show that DotA has an appropriate value similar as the board games and sports games. Similar as real sports seesaw game, fighting game is a video game genre in which a player controls an on-screen character and engages in close combat with an opponent. These characters tend to be of equal power and they will fight matches consisting of several rounds, which take place in an arena. This theory can be widely applied to various types of game to assess the entertainment impact of target games.

As for the video game "StarCraft II", we also have some achievement in society science domain. Japanese do not know about StarCraft II or other Real Time Strategy game and MOBA game when they are asked. Besides the nature science part about game refinement theory and opening strategy, we should also pay attention on the society part and then

find out why Japanese market and players have not accepted the Western game, from this point to analyze the macroscopic problem between Japan and China game market. In ancient times, classic board games developed and dispersed throughout all the world. However, in recent years the game industry is developing fast in many countries. Japanese games and Chinese games all have similar opportunities and problems in the modern context. The most serious problem facing both is "sakoku", seclusion from the outside world. Although the effects of sakoku are very far-reaching, we look at the effects of seclusion from the outside world on game development. The Chinese game industry is in the development period and the Japanese game industry is in its heyday. If the sakoku problem is not to be solved, we predict the Japanese game industry will decline and fall behind that of the West. Some genius Japanese game designers such as Kojima Hideo and Inafune Keji have already said as much. For their part, Chinese developers who fail to address gamers beyond their borders stand to lose the best chance to step into the development of the gaming future.