SOCIAL NETWORK BEHAVIOURS TO EXPLAIN THE SPREAD OF ONLINE GAME

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ABSTRACT

One of the most popular contents on the internet nowadays is the game. An online game is a video game that is played through the internet or another computer network. Online gaming is a multi-billion dollar industry that entertains a large, global population. However, only a few studies were conducted on how online games become widely spread. This study aims to understand the underlying factors that lead to the rapid spreading of online games through simulation. This could be a basis for game developers in choosing the right platform in order to infiltrate the most number of potential gamers. The result of the study can be utilized by game industry as their basis in designing the viable marketing strategy for online games The factors namely the average online friends who access the network and the chances that lead to playing network games was simulated through a NetLogo software, an agent-based model, to understand the spread of online games. This model exhibits the spread of a computer virus through a network in which each node represents a computer and it shows the progress of the spread of virus in the network. The model is similar to the spread of online games as each node in the network is parallel to the online gamer. The results indicated that the average online friends who access the network (Degree) significantly affect the spread of online games. However, two caveats are needed to popularize the game. One way is to develop the game in a platform where social networks are already established like Facebook, Twitter, Google+, LinkedIn and the like. Secondly, build an online social network on top of the digital games delivery platform such as Steam Community. Likewise, the spread of online game depends likely on the type of game, the number of friends who are game players and their frequency of exposure to online games.

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Keywords: *internet/network, online games, agent-based model/NetLogo software*

Introduction

An online game is a video game that is played through the internet or another computer network. The Internet connects millions of computers forming a network in which they can communicate with each other as long as they are both connected to the Internet. The Internet has been used to trade various kinds of contents. One of the most available online contents is the game, in which a person can play not only with the use of PCs, consoles, and mobile devices but with the span of many genres including first-person shooters, strategy games and massively multiplayer and online role-playing games compute (Adams 2006). Online games can be downloaded for free or with cost through an app store, Google play, play store and the like. It can be easily popular depending on the following factors namely, the role of technology use, emotional responses, and game enjoyment that contributes to players' decision to share the game according to Cohen (2014).

Lee, et al. (2012) investigated why people are attracted to online games, and they identify six dimensions which include the following: social interaction, self-presentation, fantasy/role playing, passing the time/escapism, entertainment, and challenge/competition. According to Dongseong and Jinwoo (2004), the market of an online game goes up. As of 2012, there is already 77.9 million gamer's audience in US alone according to Social Gaming Report. Only about two and a half billion people use the Internet from the global population of more than 7 billion. However, there are over

6.5 billion mobile subscribers worldwide. South Asia, Central America, the Middle East and Africa are the most under-represented regions regarding online access due to lack of broadband infrastructure. In China, there is an increase of 34% in games revenue in 2012, and online gaming is 94% of the pie provided by State of Gaming 2015.

Among the three types of online gaming genres in the study of Ghuman (2012), he examines the behaviour and characteristic of online gamer and he found out that Role Play Games (RPG) had the highest percentage of female players. He also found out that RPG is significantly played longer hours than other online gaming genres and had the highest engagement levels. Moreover, Griffiths, et al. (2004) examined the playing frequency, playing history, the favorite and least favorite aspects of playing the game and what they sacrifice (e.g., sleep, time with family and/or partner, work, or schooling) just to play the game. It was revealed in his study that 81% of online game players were male, and that the mean age of players was 27.9 years of age. Most of the players consider that the most important factor in playing were the social aspects of the game. Social interaction between online multiplayers according to Siitonen (2007) typically encourage interaction between players. It is a playground which can give the players the clue about the future of social and technological developments. The popularity of social networks such as Facebook has meant that they have users from all over the world according to Kohli et al. (2011). Thus, it captures how online gamers can relate to each other or how they play differently with people they know as opposed to strangers.

There are some studies conducted related to the spread of innovations like online games. Montanari and Saberi(2010) focuses on the structure of online social networks if it favors the spread of all innovations and the impact of the structure of a social network on the spread of innovations address these questions by using Epidemic vs. Game-Theoretic Models.Virus in A Network model from the NetLogo library has been modified by Djidjev(2015) to model the different structure of network topology and how it affects the spread of computer virus in the network.

According to Blackburn et, al. an online social network built on top of the world's dominant digital game delivery platform. Online gaming is a multi-billion dollar industry that entertains a large, global population.

This study aims to understand the underlying factors that lead to the rapid spreading of online games which could be a basis for game developers in choosing the right platform in order to infiltrate the most number of potential gamers. The result of the study can be utilized by game industry as their basis in designing the viable marketing strategy for online games. Nowadays, video game industry has established a significant contribution to the global entertainment economy.

Conceptual Framework

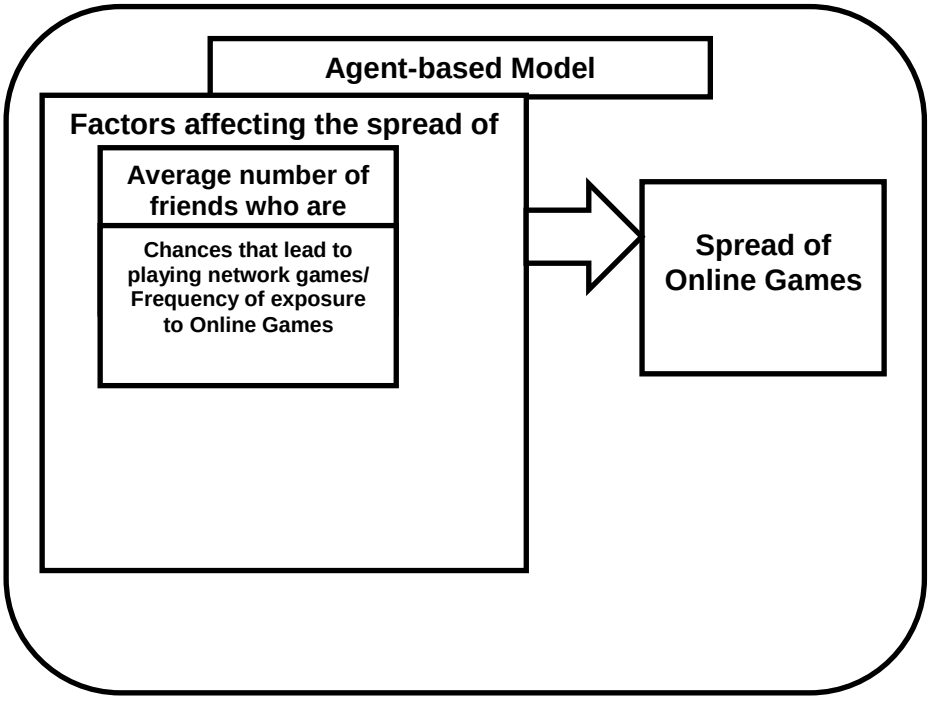

Figure 1.Conceptual Framework of the Spread of Online Games

The figure shows the relationship between the factors affecting the spread of online games namely the average number of friends who are game players and the chances that lead to playing network games/frequency of exposure to online games is simulated using a NetLogo software, an agent-based modeling tool to understand the spread of online games. Based on the survey conducted by Entertainment Software Association in America in 2016, 47% of online gamers are between ages 18 to 49 years old and they have been playing online games for 13 years. According to the survey, the average time where online gamers spend in playing with others reach to 6.5 hours a week. 56% of the online gamers are using personal computer, 53% are using dedicated consoles and 36% used smartphones. According to Dongseong and Jinwoo(2004), people access the network and play online games primarily to have a good experience, and the value of an online game can be determined after they play it. The spread of online game depends likely on the type of game, the number of friends who are game players and their frequency of exposure to online games.

Research Design and Methods

An agent-based modeling software called NetLogo is utilized to simulate the spread of online games. Among the different models available in NetLogo software, the researchers choose Virus on Network to understand the spread of online game through a network. This model exhibits the spread of a computer virus through a network in which each node represents a computer and it shows the progress of the spread of virus in the network. The model is similar to the spread of online games as each node in the network is parallel to the online gamer. Moreover, the states of the nodes– susceptible is comparable to a person who is a possible player who got friends that are online gamers; infected state is the same as the person who was influenced to become a online game player and; Resistant state is equivalent to a person who does not play online game anymore. The parameters are correlated through a concept mapping to understand the spread of online games as shown in table 1.

Parameters of Virus on Network Model	Equivalent Parameters of Spread of Online Game
Number of Nodes	Number of Game Players
Average Node Degree	**Average number of friends who are Game Players**
Initial-outbreak size	Number of initial game players
Virus-spread-chance	**Chances that lead to playing network games/Frequency of Exposure to Online Games**
Virus-check-frequency	Frequency of when an online game is accessed
Recovery-chance	Chances of players to stop or not playing online games anymore
Gain-resistance-chance	Probability of not playing again after having played once or more times
Susceptible *Infected* *Resistant*	*Not yet players but have friends who are online gamers* *Network game player* *Not a player anymore*

Table 1. Concept Map on Virus on Network vs. Spread of Online Game

Table 1 shows the concept map of the virus on network model vs. the spread of the online game. The researchers have the assumption that average online friends who access the network and the chances that lead to playing network games are the factors in determining the spread of the online game. To analyze the effect of *Average number of friends who are Game Players (Degree)*and *Chances that lead to playing network games (Chances of spreading)* to the rate of the spread of the online game, a two-factor analysis is done. The study provides information on the effects of the two factors and the interaction effects.

The simulation process to show the spread of online games are undertaken:

1. Launch the Netlogo application version 5.2.1 and its Model Library. Choose the Networks category and double click Virus on Network (Stonedahl and Wilensky, 2008).

   1.1 Click the SETUP button in order to setup the model. Each node represents a computer and the progress of a computer virus or worm through the network.

   1.2 Click the GO button to start the simulation. Each node may be in one of the states: Susceptible, Infected, or Resistant.

   1.3 Set the parameters at the following:

      1.3.1 Number-of-nodes slider is set to 150 in all simulations. The number of nodes is the number of computers in the network.

      1.3.2 Average-node-degree slider has a range value of 1 - 149, any numerical value below 75 is low; 75 and above is high. The average node degree is the number of network connections or the average number of links coming out of each node. This is one of the factors that will affect the spread of the online games.

1.3.3 Initial-outbreak-size slider value is set to 3. Initial outbreak size is the number of computers infected by virus at the start of simulation.

1.3.4 Virus-spread-chance is set at a maximum percentage of 10%, any percentage below 5% is low; above 5% is high. The virus spread chance is the probability of spreading the virus.

1.3.5 Virus-check-frequency is the number of times the computers perform virus scan. The slider is set at 1.

1.3.6 Recovery-chance is the chances of removing or deleting computer virus. The slider is set at 5%.

1.3.7 Gain-resistance-chance is the chance of computers to be resistant to virus. The slider is set to 5%.

2. Create four scenarios from Virus on Network model by varying the two factors: Factor A - average online friends who access the network; and Factor B - the chances that lead to playing network games. Variations are LOW at a value of 0 and HIGH at a value of 1. The following scenarios are:

    - Factors A and B are LOW;
    - Factors A is LOW and Factor B is HIGH;
    - Factor A is HIGH and Factor B is LOW; and
    - Factor A and B are HIGH.

3. Simulate the scenario ten (10) times and record the time when the spread of online games is at its highest level to see the significant difference of every simulation.

In the simulation process, the *Number of Computer Users* is set to 150,and the *Number of initial network game players* is set to 3. The *Checking of when an online game is accessed* is set to 1, and the *Chances of players to stop or not playing online games anymore* is set to 5.0. The *Probability of not playing again after having played once or more times* is set to 5% in all the scenarios as shown in Figure 2.

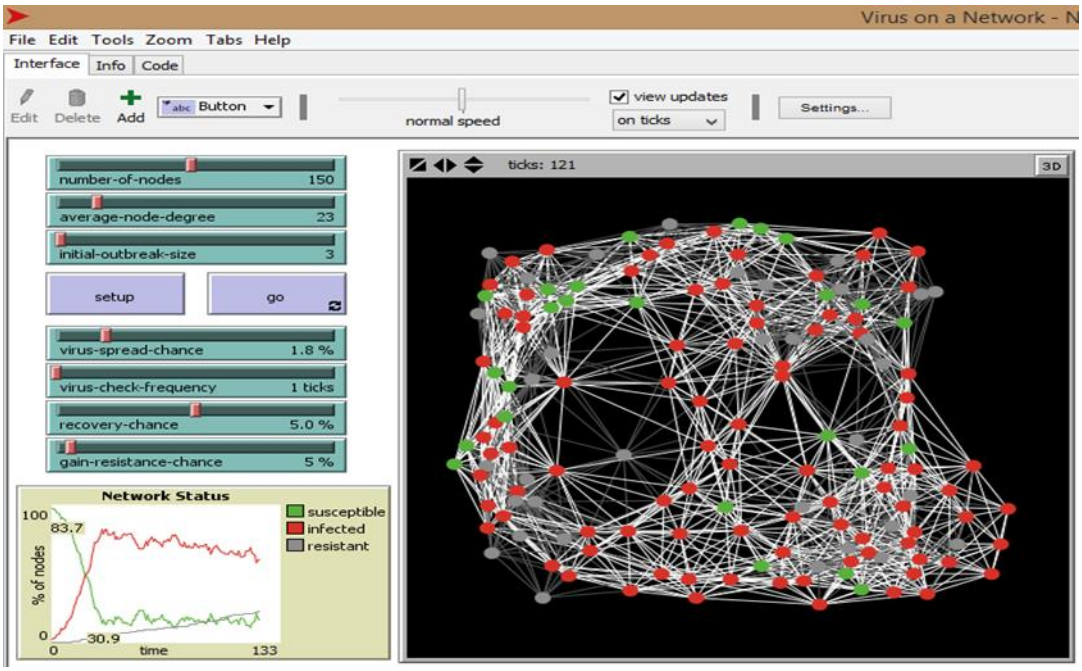

Figure 2. Sample Simulation using NetLogo Software using Virus on Network Model as mapped to Spread of Online Game

Results and Discussions

There are four scenarios simulated using the model. The values of the two factors namely degree and spread-chance was set to Low, which was represented by 0 and High which wasrepresented by 1. In every simulation, the time when the spread of online games was recorded at its highest level.

Time when the spread of online game is at the highest level (Time in months)	*Average online friends who access the network (Degree)*	*Chances that lead to playing network games (Spread-Chance)*
67	0	0
291	0	0
77	0	0
47	0	0
39.5	0	0
31	0	0
20.5	0	0
24.4	0	0
13.5	0	0
30.9	0	0
Mean =64.18		

Table 2. Scenario 1 when Degree and Spread-Chance are Low

Table 2 shows that the time has an average of 64.18 months for an online to reach its peak of popularity. Scenario 1 indicates that the degree is set to low, and the spread-chance is also set to low. Having a low value of the degree means that there are only a few friends who access the network, and low spread-chance denotes that likelihood that leads to playing network games are also low. Low spread-chance means only a few game requests received from an online friends and fewer exposures to game advertisements and promotions.

Time when the spread of online game is at the highest level (Time in months)	*Average online friends who access the network (Degree)*	*Chances that lead to playing network games (Spread-Chance)*
116	0	1
39.5	0	1
36.6	0	1
14.6	0	1
8.7	0	1
11.5	0	1
30.5	0	1
17.2	0	1
13	0	1
10.8	0	1
Mean=29.84		

Table 3 Scenario 2 when Degree is Low and Spread-Chance is High

Scenario 2 indicates that the degree is set to low, and the spread-chance is set to high. Having a low value of the degree means that there are only a few friends who access the network, and high spread-chance denotes the chances that lead to playing network games are also high. High spread-chance means only many game requests received from online friends and more exposures to game advertisements and promotions. Table 3 shows that the time has an average of 29.84 months for an online to reach its peak of popularity.

Time when the spread of online game is at the highest level (Time in months)	*Average online friends who access the network (Degree)*	*Chances that lead to playing network games (Spread-Chance)*
13.8	1	0
8.1	1	0
6.7	1	0
17.1	1	0
13	1	0
6.9	1	0
6.4	1	0
5.4	1	0
5.4	1	0
9.1	1	0
Mean= 9.19		

Table 4. Scenario 3 When Degree is High and Spread-Chance is Low

Scenario 3 indicates that the degree is set to high, and the spread-chance is set to low. Having a high value of the degree means that there are only plenty offriends who access the network and low spread-chance denotes the chances that lead to playing network gamesare also low. Low spread-chance means only few game requests received from online friends and few exposures to game advertisements and promotions. Table 4 shows that the time has an average of 9.19 months for an online to reach its peak of popularity

Time when the spread of online game is at the highest level (Time in months)	*Average online friends who access the network (Degree)*	*Chances that lead to playing network games (Spread-Chance)*
5	1	1
2.7	1	1
7	1	1
3.4	1	1
3.4	1	1
5	1	1
2.7	1	1
4	1	1
3	1	1
3.4	1	1
Mean=3.96		

Table 5. Scenario 4 when Degree is High and Spread-Chance is High

Average Time when the spread of online game is at the highest level (Time in months)	*Average online friends who access the network (Degree)*	*Chances that lead to playing network games (Spread-Chance)*
64.18	0	0
29.84	0	1
9.19	1	0
3.96	1	1

Table 6. Average Time in the four (4) Scenario

Table 6 presents the average time in months when the spread of online game is at the highest. It shows that the fastest time for an online game to spread in the network is when the number of online friends who accessed the network is many and the chances of playing network games is high which is only 3.96 months compared when the two factors are set to low that will take 64.18 months.

To further analyze which of the two factors has a greater effect on the spread of online games, a two-way ANOVA analysis is done. The figure is shown below.

Source		***DF***	***SS***	***MS***		***F***	***P***	
Degree	1	16349.9		16349.	9	8.37	0.006	
Spread-Chance	1	3914.5		3914.5	2.00	0.166		
Interaction		1		2118.5		2118.5	1.08	0.305
Error	36	70339.5		1953.9				
Total	39	92722.3						

S = 44.20 R-Sq = 24.14% R-Sq(adj) = 17.82%

Figure 3.Two-way ANOVA: Time in months versus Degree (Spread-Chance)

Figure 3 implies that it is the average online friends who access the network (Degree) that greatly affects the spread of online games with the value of 8.37. It is very vital that an online game is introduced in an environment that is already established like social networking sites. Also, game developers should develop games in platforms that have already an existing number of connections.

Conclusions

Based on the study, one factor that significantly affects the spread of online game is the average number of friends who are game players (degree) which means that the greater is the average-node-degree or greater is the number of friends who are online gamers , the faster is an online game to spread. One way to spread is to develop the game in a platform where social networks are already established like Facebook, Twitter, Google+, LinkedIn and the like. Another way to spread the game is to build an online social network on top of the digital games delivery platform such as Steam Community.

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