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JLootBox: An Agent-Based Model of Social Influence and Gambling in Online Video Games

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JLootBox: An Agent-Based Model of Social Influence and Gambling in Online Video Games

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JLootBox: An Agent-Based Model of Social Influence and Gambling in Online Video Games

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Introduction

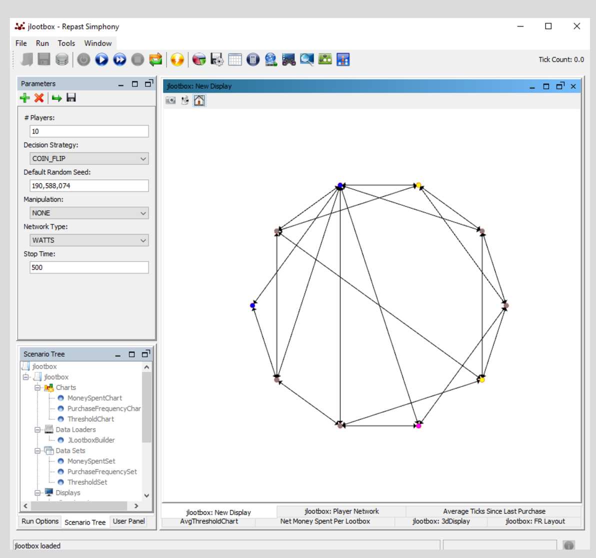
Loot boxes are digital treasure chests that players spend real/in-game currency to purchase wherein the contents are randomly generated. Since players spend money not for a guaranteed item, but for the *chance* they may receive something valuable, many comparisons have been drawn to gambling behavior in recent years. To explore the development of this behavior, an agent-based model will be used to simulate player interactions, individual player choices, etc. Agent-based modeling allows us to create heterogenous agents who follow simple rules so that we may observe emergent behavior in a population. Through this, we may observe how player agents may fall into repeated purchases through different means.

Research Goal

To demonstrate how influence from one's social network may lead to habitual spending on items with chance-based rewards, otherwise known as gambling. Additional influences investigated are a player's own purchase strategy, and common manipulations used by games today.

Methods

Using Repast Simphony, an agent-based model was created wherein players are represented by circles that are interconnected depending on the network structure selected. Each player has a static amount of money at their disposal, as well as variable "buyThreshold" that determines how likely they are to make a purchase. Agents are initialized with a decision strategy that determines how they decide to purchase/abstain from lootbox transactions. Agents can also be manipulated by the game with common strategies utilized from modern games today.

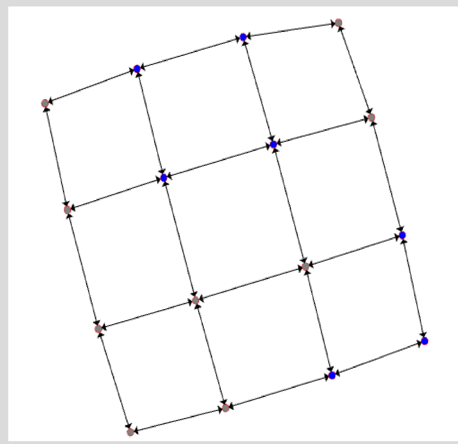


Decision Strat:
- ALWAYS_BUY
- COIN_FLIP
- PRICE

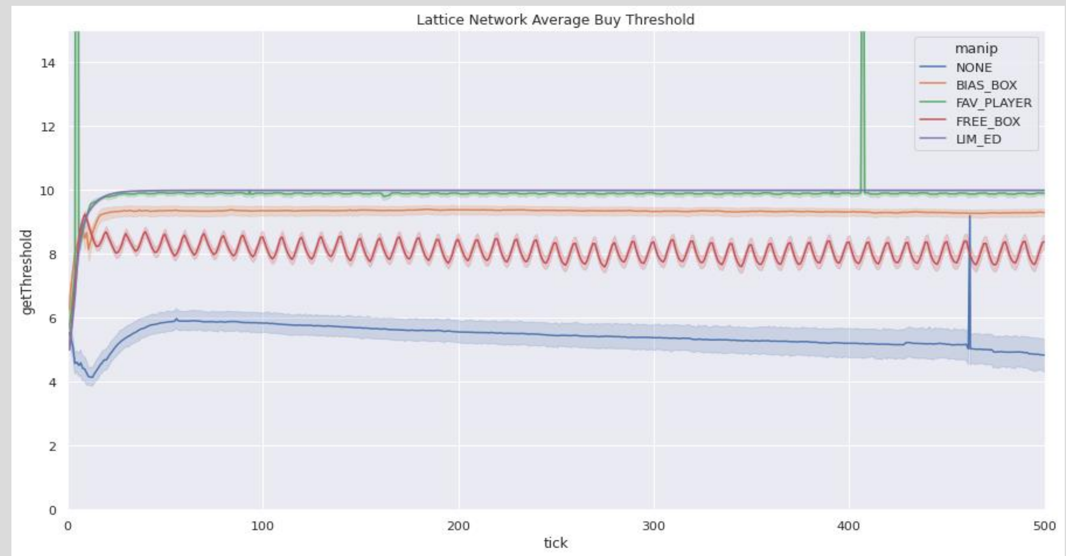
Manipulation:
- FREE_BOX
- LIM_ED
- BIAS_BOX
- FAV_PLAYER
- NONE

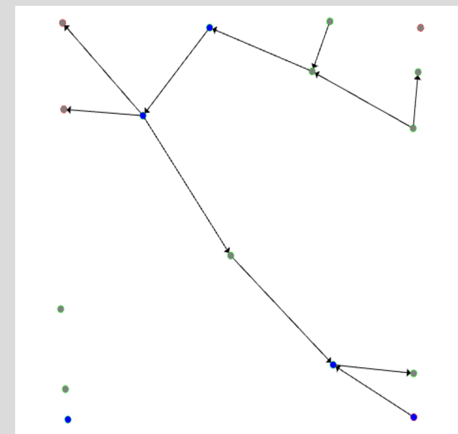
Network:
- WATTS
- RANDOM
- LATTICE

Figures and Results

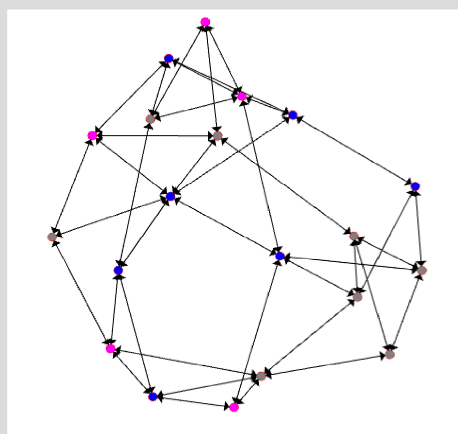


Lattice Network

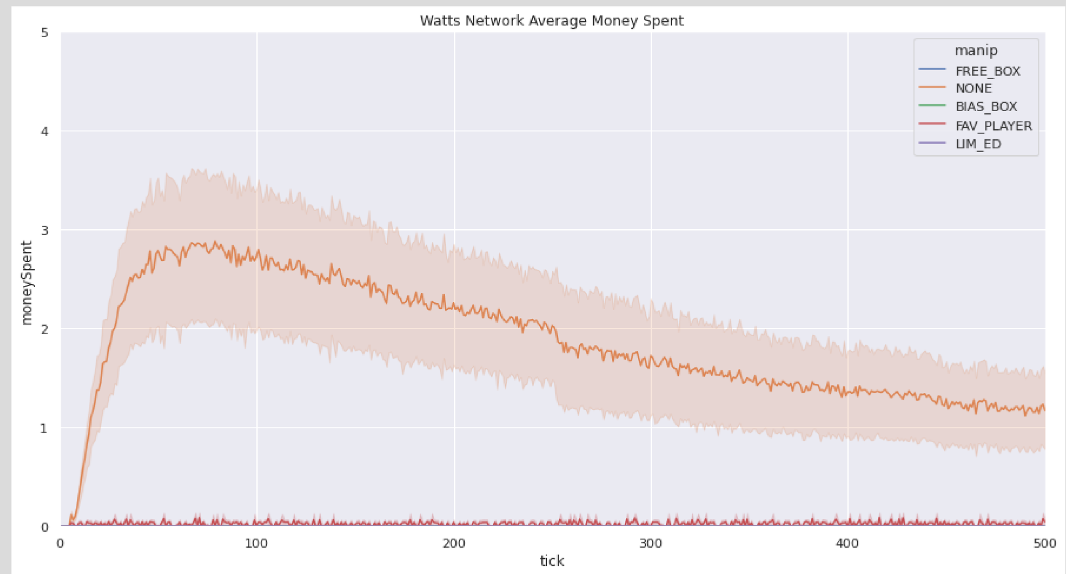


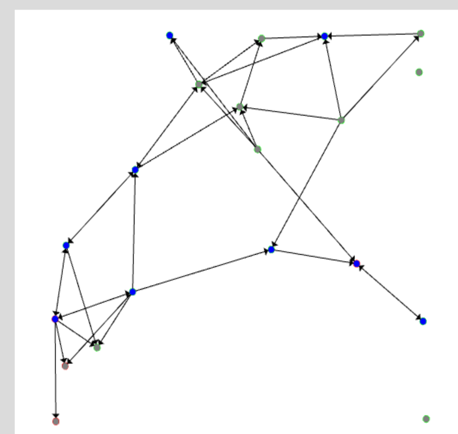


Lattice Result

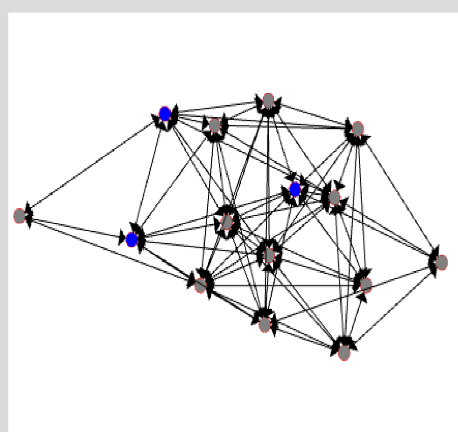


Watts Network

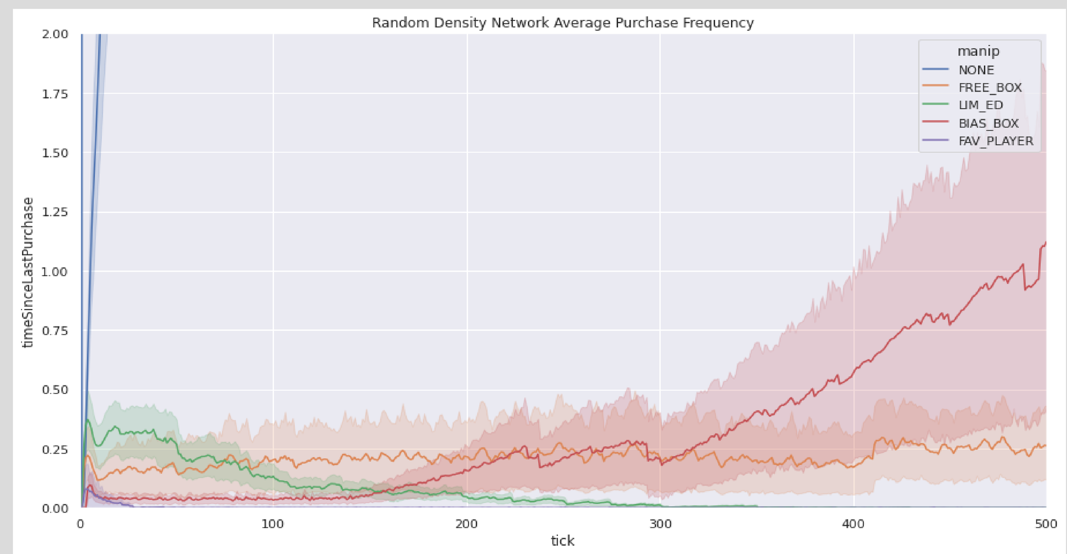


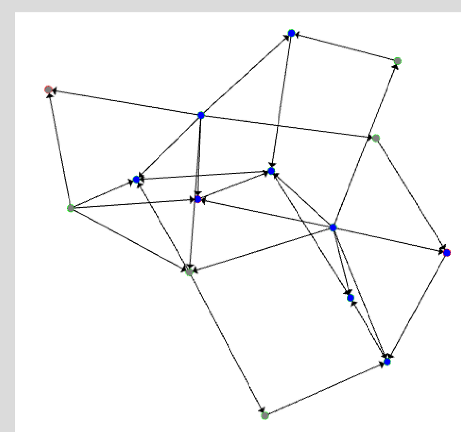


Watts Result



Random Network



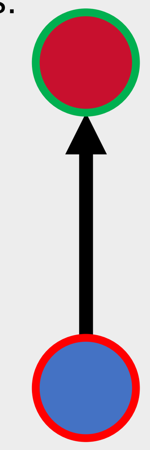


Random Result

The graphs represented in the center are instances in which that network type differed the most from its counterparts. Within a lattice structure, we can see that manipulating the players keeps their buyThreshold consistently near its max value 10, increasing their likelihood to make a purchase. Without any manipulation, the buyThreshold maintains its position near the default of 5. As for the lattice network itself, its nodes are the most isolated out of all three network types after the simulation is run. The Watts network displayed the most interesting behavior for average money spent, as having zero manipulations present encouraged more spending than all the manipulations combined. This network was not as fragmented as the lattice, but it did allow a few nodes to become isolated. The random network generated the most interesting purchase frequency behavior of any structure, maintaining the average purchase frequency below half a tick for almost all the manipulations. This was the anticipated behavior of the manipulations, as a run with no manipulations allowed players to go more than a few ticks without purchasing a box but the manipulations pressured more frequent transactions. The random network maintained its structure best out of the three, allowing all nodes to preserve connections to their peers.

Algorithms/Batch Runs

Each tick, a player goes through a series of steps:
- If they decide to buy a lootbox, they update their buyThreshold based on the value of the box. Manipulations are then processed.
- If they decide not to buy, they look at their peer's lootbox luck to update their buyThreshold



For batch runs, a parameter sweep was run over all network types, manipulations used, decision strategies, and the player number used. Player number specifically was incremented from 100-1000 over each iteration of the run.

Conclusion and Future Improvements

Regardless of the manipulation or decision strategy utilized by the players, nothing had a more substantial influence over their behavior as their social network connections. The manipulations performed similarly across each network type with little variation. Players who were totally isolated made fewer purchases than those who were well connected, and were not impacted by the manipulations as sharply as their peers.

Though further research should be conducted, it does appear from the model that a player's social network has strong influence over their likelihood to engage in and fall victim to gambling-like behavior with in-game purchases.

Future improvements/optimizations to the model's code may allow for more direct comparisons to real-world loot box generation, more robust data collection, and more nuanced relationships between agents. For example, certain risk factors may make an individual agent more or less likely than a peer to become addicted on their own, without outside influence.

References/ Acknowledgements

Dr. Murphy for his area expertise and boundless patience!

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JLootBox: An Agent-Based Model of Social Influence and Gambling in Online Video Games

Abstract:

Loot boxes are digital treasure chests that players spend real money to purchase, wherein the contents are randomly generated. Since players spend money on the pretense they might receive something valuable, many comparisons have been drawn to gambling behavior as the reward is up to chance. To explore this phenomenon, agent-based modeling will be used to simulate this behavior. Agent-based modeling allows us to create heterogenous agents who follow simple rules so that we may observe emergent behavior in a population. An agent-based model was created using Repast Simphony for this end.

Parameters included the player's internal decision strategy around purchases, the number of players, the network type used to generate connections between player nodes, and the manipulation strategy used by the game. Batch runs of the model were conducted to sweep over these parameters and collect data regarding the purchase trends. Lattice networks lead to more isolated players, where game manipulations were predictably effective on keeping the players habitually spending. Watts networks lead to less isolation, but interestingly the manipulations reduced player likelihood to spend large amounts of money on a new loot box. Random density networks lead to the most interconnected nodes, where interactions between nodes lead to the shortest purchase frequency time at less than half a tick of runtime.

Network structure influenced player behavior more than decision strategy or manipulation used. Players who were totally isolated made fewer purchases than those who were well connected, and were not impacted by the manipulations as sharply as their peers. Though further research and optimizations to the model are needed, it does appear from the model that a

player's social network has strong influence over their likelihood to engage in and fall victim to gambling-like behavior with in-game purchases.

Installation Notes:

If you would like to avoid the installation process, a video of the simulation running can be found here: https://www.youtube.com/watch?v=jPlsq5coPkA

To access and install the most current version of the model, please first ensure Java (version 1.8 or greater) is installed on your machine. If you do not have Java installed, you can find the download link here. Run the Java installer, and you should be presented with a message informing you Java has successfully been installed. To access the model, download the model by clicking "Source code (zip)" at the following link, and unzip the file named "setup.zip". Double clicking the file and run it with Java. It should then guide you through another installation guide, before finally allowing you to open the model and run it. To run the model, click the blue power button on the top panel, then the play button to run the simulation. The parameters in the left panel can be tinkered with to see how it affects the player network.

The model is published on COMSES here: https://www.comses.net/codebases/64d2795a-a138-4820-82c1-279d3a8ef661/releases/1.0.0/

The model's code and progression can be viewed here: https://github.com/LilasCorner/jlootbox

Extended Reading:

Since the model was presented at NIU's CURE event, much of its underlying code has changed. There are more parameters the user can interact with on the interface, and refactoring done to the code to split it from two main .java files into three. These files are responsible for the luck behind the loot box's generation, the player's choices and interactions, and the "platform", or in this case the game, as it manipulates/guides the players. This allows the code to be much more modular, and more easily editable by others wishing to expand the model. More graphs have been added to allow users to track an agent's development over time, rather than aggregate the results of all agents into one graph. This allows you to see why an agent might justify a purchase to himself one turn (he may have been on a hot-streak, for example), and why he might not justify that purchase the next round (hot-streak has sadly ended). Other additions to the model include the parameterization of "magic number" variables that guided the creation and initialization of each network type. The Watts, Random, and Lattice networks can all be customized per run, and the user can conduct a parameter sweep over these variables if they want with Repast's batch run mode.

University Honors Program
Capstone Faculty Approval Page

Capstone Title (print or type)

JLootBox: An Agent-Based Model of Social Influence and Gambling in Online Video Games

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Department of (print or type) Computer Science

Date of Approval (print or type) 5/6/22

Date and Venue of Presentation 4/26/22, NIU's CURE Event

Check if any of the following apply, and please tell us where and how it was published:

☑ Capstone has been published (Journal/Outlet):

COMSES Model Archive, full model code and documentation uploaded at:
https://www.comses.net/codebases/64d2795a-a138-4820-82c1-279d3a8ef661/releases/1.0.0

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