The untapped potential of virtual game worlds to shed light on real world epidemics

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Summary

Existing methods, an accident in game and potential methods inspired by it

What are the existing methods in epidemic research?

What are their disadvantages?

Disease dynamics in animals

Experimental study

"...physically impossible, financially prohibitive, or morally reprehensible to create a controlled, empirical study where the parameters of the disease are already known before the course of epidemic spread is followed." (Lofgren and Fefferman, 2007)

Observational and retrospective study

Less controlled environment.

Risk of introducing selection bias.

Difficulty in data collection and measurement.

Computer simulation

Examples

Transportation Analysis Simulation System (TRANSIMS) and Epidemiological Simulation System (EpiSims).

The actions of agents are simulated on the basis of real-world behaviors under non-outbreak conditions.

Pros and Cons

Possible to experiment on large-scale virtual population.

Lack the ability to mimic the human behaviors in real outbreak scenarios.

An accident

An unexpected outbreak of deadly disease (“Corrupted Blood”) happened in World of Warcraft on September, 2005.

The disease was expected to be encountered only in a newly accessible area; nevertheless, it spread out to the capital cities.

Figure 1: Urban centre in World of Warcraft during the epidemic

(Lofgren and Fefferman, 2007)

The designers' expectation

The area, Zul'Gurub, was designed for the senior players, with the contagious disease "Corrupted Blood" as a hindrance.

The players explored the area should have been killed by the deadly disease or the monster, or have been cured.

Figure 2: Hakkar, the primary source of infection in World of Warcraft

(Lofgren and Fefferman, 2007)

What caused the outbreak?

The ability of teleportation

The ability of teleportation allowed the victims to reach the capitals before either being killed by or cured of the disease.

In real-world history, many disease outbreaks were related to the long-distance travels of the infectors.

The interspecies transmission

The interspecies transmission between the players and their pets contributed to the epidemic as well.

According to the game data, the pets, instead of the infective characters, played the leading role in the outbreak.

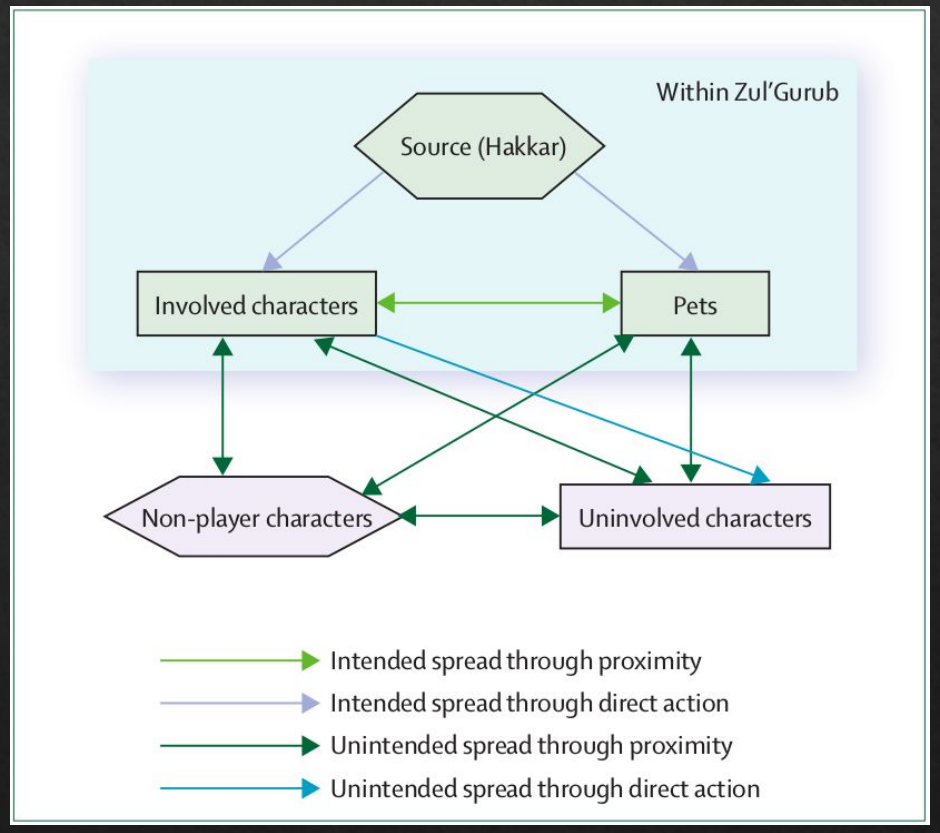

Figure 3: Chain of infection of novel virtual pathogen

(Lofgren and Fefferman, 2007)

Games as agent-based models

Advantage

Compared to traditional epidemiological studies, it can involve a significant larger number of agents.

Compared to purely computational simulation, the human behaviors are more similar to those in real world, rather than simulation by random algorithms.

Limitation

The actions in games can still be different from those in real world.

Because of the computational consumption and the limitation of subscriber base, those types of simulation will be scarcely possible to reach the scale of purely computational simulation.

MMORPGs as experimental laboratories

The experiments can be incorporated into the games, so the players will have the coherent gaming experience instead of realizing they are participating in an epidemiological simulation.

Unlike the studies involving human patients, those in gaming systems are less restricted in morality and privacy concerns.

"...the ability to repeat such experiments on different portions of the player population within the game...could act as a detailed, repeatable, accessible, and open standard for epidemiological studies, allowing for confirmation and the alternative analysis of results." (Lofgren and Fefferman, 2007)

Conclusion

Conducting simulations in games can be a future experimental method and a new direction of the epidemiological research.

It has "...the potential to bridge the gap between traditional epidemiological studies on populations and large-scale computer simulations..." with

"...unprogrammed human behaviour...";

"...large numbers of test participants...";

"...controlled environment...";

"...disease parameters are known...". (Lofgren and Fefferman, 2007)

Review

Strengths, Weaknesses and Extensions

Analysis of Corrupted Blood (strength one)

The paper examines the accident in World of Warcraft and analyzes the reasons of the unexpected outbreak. It proposes two plausible reasons (transportation of contagious carriers and interspecies transmission) and compares it to the causes of disease outbreaks in real world.

This analysis illustrates the potential of games in epidemiological research by showing the same factors can contribute to the outbreaks in both scenarios.

The real-virtual connection (strength two)

Intuitively, the behaviors of the agents controlled by human beings can be significant different from those of the controllers themselves in real world. For example, they are less averse to the riskier behaviors when capable of resurrection.

The author took the difference into consideration. He argued that with all the commitment and the social relations in the virtual world, the players would experience serious and emotional consequences of their actions. Thus the difference could be limited and estimated.

Comparison to existing methods (strength three)

The paper compares the proposed method to the existing ones. This comparison clarifies the position and the potential of the new method by examining the advantages and disadvantages.

The new method bridges the gap of the two existing methods, and provides another choice in certain circumstances:

- Unprogrammed human behaviour;
- Large numbers of test participants;
- Controlled environment;
- Disease parameters need to be known.

Lack of proof (weakness one)

This paper proposes that online games could be used as simulations in epidemiological studies, but it does not provide any theoretical proof or experimental validation. From the scientific perspective, it lacks rigor.

Measuring dissimilarity of behaviours (weakness two)

Considering the huge difference between the real and virtual worlds and the unpredictability of human reactions, the dissimilarity of behaviours is possibly unable to be measured and estimated.

For example, many players will kill other characters, even their friends', without any moral burden, which is different from real-world behaviours and can make a significant difference in the results.

The will of gaming industry (weakness three)

Without regard to the potential in research, the gaming industry is unlikely to benefit from those experimentations.

The extra goals of involving epidemiological experiments can be harmful to the players' gaming experience.

The expense of game development is usually ultrahigh, which would lower the developers' will of taking the extra risk.

Study of human behaviors in games (extension one)

Instead of setting up experiments directly in games, we can alternatively collect the reactions of human players within a few representative epidemiological experiment, which will make it possible to build a simulation of human behavior in outbreak conditions.

The online games can provide explicit, detailed data of massive players, including their actions in normal and outbreak conditions, the preferences, the social relations in the game etc.

It has the potential to reduce the cost and the time, and extend the experiment to the same scale of pure computer simulation.

Experiments as game elements (extention two)

The experiments can be designed and incorporated into multiple aspects of the games, which will not only make the gaming experience coherent and examine the reactions of the players, but also make it possible to involve the intelligence of the players into research.

For example, the virus can be made into biological weapons to be used in the conflicts and competitions between multiple realms. In this setting, the players will have the motivation to exploit strategies to both maximize the destructiveness and protect their own realms from the biological attacks. Except for the data in those special scenarios, the player-designed strategies can be also considered as references in anti-terrorism research.

References

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Thank you!

Q & A