



Essential Workers: A Multiplayer Game for Enacting Patterns of Social Interdependency in a Pandemic

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Figure 1: *Essential Workers* Title Screen.

ABSTRACT

In order to understand a pandemic like the COVID-19 crisis of 2020, we have to keep in mind larger patterns (e.g., information visualizations such as charts), and individual perspectives (e.g., interviews). However, it is challenging to connect these larger patterns with lived experiences. In this work-in-progress paper, we argue that interactive digital experiences such as games have the potential to bridge this gap by allowing players to explore the pandemic at multiple levels of abstraction. We present *Essential Workers*: an online multiplayer game which situates players as one of four workers—Nurse, Grocery Worker, Office Worker, or Delivery Driver—who face difficult dilemmas as they live through three weeks of rising infection during the COVID-19 pandemic. Through a core cooperative game mechanic, *Essential Workers* seeks to tie the constraints

and choices of the individual to the health of their communities, and to simulate some of the interdependencies that keep our communities functional during the pandemic. We aim to illustrate our approach to key challenges commonly faced by designers seeking to model the entanglements of the individual and society.

CCS CONCEPTS

• **Software and its engineering** → *Interactive games*; • **Computing methodologies** → *Interactive simulation*; • **Human-centered computing** → *Collaborative interaction*.

KEYWORDS

simulation, games, epidemiology, cooperative gameplay, emergent gameplay

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CHI PLAY '20 EA, November 2–4, 2020, Virtual Event, Canada

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ACM ISBN 978-1-4503-7587-0/20/11...\$15.00
<https://doi.org/10.1145/3383668.3419863>

ACM Reference Format:

Aditya Anupam, Colin Stricklin, Jordan Graves, Kevin Tang, Michael Vogel, Marian Dominguez-Mirazo, and Janet Murray. 2020. *Essential Workers: A Multiplayer Game for Enacting Patterns of Social Interdependency in a Pandemic*. In *Extended Abstracts of the 2020 Annual Symposium on Computer-Human Interaction in Play (CHI PLAY '20 EA)*, November 2–4, 2020, Virtual Event, Canada. ACM, New York, NY, USA, 5 pages. <https://doi.org/10.1145/3383668.3419863>

1 INTRODUCTION

The rise and rapid spread of COVID-19 has been communicated through several explanatory media such as charts [9], interactive visualizations [3], newspaper features [12], YouTube [7] or television news videos [6], and social media posts [1]. But there is a gap between those that focus at the macroscopic level—the number of cases over time in a city, county, state or country, and those that focus on the immediate experience of individuals who are infected by and transmit the disease.

Data visualization, such as the COVID-19 Dashboard by the Center for Systems Science and Engineering at Johns Hopkins University [3], are well suited to describing matters at the macroscopic scale. They can make clear the difference between, for example, New York and Georgia in flattening the curve and sustaining reduced levels of infection.

Conversely, narrative media such as local news reports and autobiographical social media posts are useful in describing situations at the personal level. For instance, they can highlight how several employees of a grocery store in the same city recently displayed symptoms of COVID-19 and had to quarantine [5] or how nurses are dealing with a deficiency of personal protective equipment (PPE) [13].

Both of these forms of explanatory information are of vital importance to the public understanding of a pandemic, but the situation of a pandemic demands that citizens mediate between these two perspectives, connecting the collective rate of infection with their own choices, understanding how these individual choices play out in the lives of their fellow citizens, and seeing the entanglements between these individual fates and the shared reality of the pandemic.

In this paper, we argue that interactive digital experiences such as games have the potential to foster deeper understanding of these entanglements by allowing players to explore the pandemic at multiple levels of abstraction. Specifically, they can allow players to experience the pandemic from the point of view of individuals as well as making clear patterns of causation across the larger community.

To exemplify our argument, we present *Essential Workers*: an online multiplayer game which aims to situate players as one of four workers—Nurse, Grocery Worker, Office Worker, or Delivery Driver—who face difficult choices as they attempt to live through the COVID-19 pandemic. To win the game, all the players must survive three weeks of increasing levels of infection while maintaining stable health and finances. In order to successfully do this, each player must understand how their local actions can affect other players' characters and the larger community. Through a core cooperative game mechanic, *Essential Workers* seeks to connect individual action to larger effects, and to simulate the interdependencies that keep our communities functional during the pandemic.

2 GAMEPLAY

Essential Workers is a cooperative game in which four players take on the roles of a grocery store worker, a nurse, a delivery driver, and an office worker living in a city during the height of a pandemic. In one-day time steps over the course of three weeks, players choose their daily activities (see Fig. 2), such as going to work or visiting the grocery store, while keeping themselves and others in the game

safe from the infection. After each player chooses their activities for the day, the board updates to reveal the choices of every player (see Fig. 3). As the pandemic intensifies and infection rates soar, players must manage the personal resources of Health and Money in order to survive. If any player's Health or Money falls to zero, the game is over, and everyone loses. *Essential Workers* is played online in a web browser. One player hosts the game by creating a new room and sharing the unique room code with other players. During the game, players are encouraged to chat through another video or audio chat platform to discuss the game state in order to encourage multiple perspectives on the same situation.

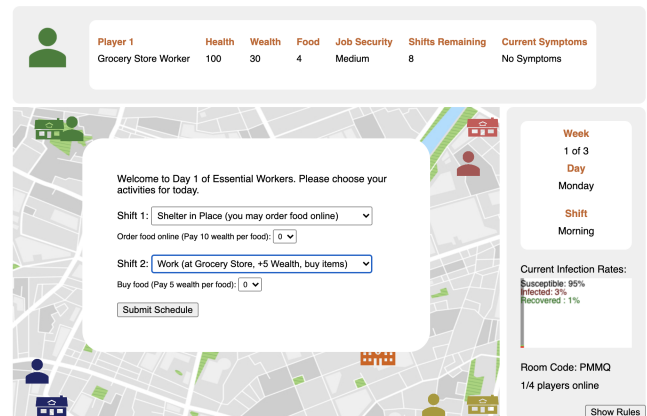


Figure 2: Choosing moves in *Essential Workers*.

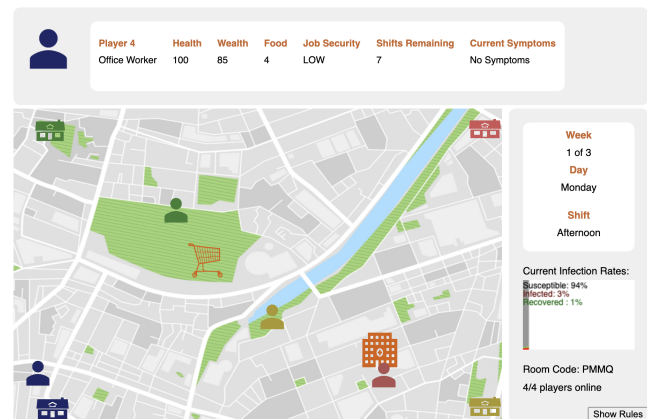


Figure 3: Player icons moving in *Essential Workers*.

Based on user-feedback (see section 4), we have also developed a single-player version of the game that functions as a tutorial for new players, guiding them through the game interface and mechanics day-by-day. The tutorial involves multiple predetermined gameplay sequences, which serve to educate the players about specific difficulties faced by essential workers as well as introducing them to the epidemiological model underlying the game.

Many choices in the game are straightforward—a player needs to work to buy food to eat and pay rent. However, the presence of the

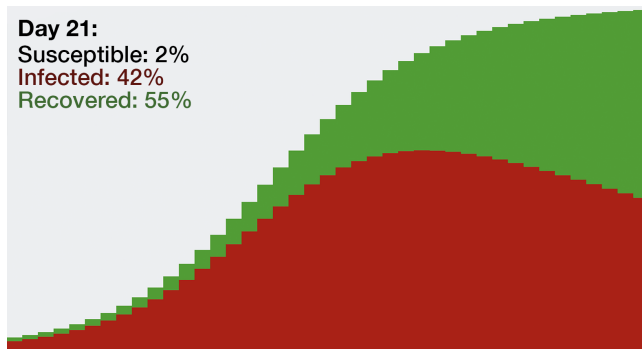


Figure 4: SIR model in *Essential Workers*.

virus turns gameplay into a series of dilemmas. A player may have to choose between risking infection by going to work or risking job security by choosing shelter. A sick player might run out of money and be forced to work and thereby spread the infection to other players.

The chance of the player getting infected varies according to their actions but also reflects the growth of infection in the population over time. A background population of the city as a whole is simulated using a basic Susceptible-Infected-Recovered (SIR) epidemiological model. The parameters and initial conditions of the game's background model resemble those used by scientists to model the COVID-19 disease. The main interface shows an SIR graph that will give the player information regarding the amount of Susceptible (S), Infected (I), and Recovered (R) people in the town at any given time (see Fig. 4). This SIR graph provides relevant information about the current state of the pandemic—as many trackers do in real life.

The SIR graph is tied to the core gameplay in two key ways. First, each time players go out, 10 other “background” people follow them (represented by small white icons similar to the player icons). The SIR graph determines approximately what fraction of these people will be susceptible/infected/recovered. For example, if the SIR graph says that 40% of the people in the city are infected, then players can expect 4 out of every 10 of these “background” people to be infected. Second, the higher the number of infected people (including players) at a given location, the greater the chances of contracting infection. As the pandemic grows, players have to become more and more careful of aggregating together in spaces as each player will bring 10 “background” people to the location with them. The role of the SIR graph therefore is to inform player decision making.

It is important to note that the SIR graph reflects the state of the city as a whole and not that of the small community in which players participate. This was a conscious decision made for two key reasons. First, real life communities within cities do not exist in isolation from the city as people move in and out of them frequently. Second, the SIR model is designed for large population sets where smaller variations average out over time. As a consequence of this decision, and in line with what epidemiological models show, the actions of individual players do not affect the evolution of the pandemic as a whole in the city, and by extension, do not register a change in the state of the SIR graph. This does not detract from

our original goal of connecting the macro and micro because it still helps players learn about the scope of individual actions in a pandemic: one can significantly impact the chances of infection at a given location or in a small community, but that effect is negligible on its own in the context of a larger city.

3 BACKGROUND

At its core, *Essential Workers* makes an ethical argument in accord with Miguel Sicart's image of players as moral beings who must develop their own codes through play, and so “decide which values, practices and discourses are morally desirable” [11]. The choices featured in *Essential Workers* allow players to position themselves as meaningful community actors. By weighing the risks of a changing infection rate against their character's health and financial needs, players connect macroscopic trends to personal decisions. For example, if the risk of infection on the SIR graph spikes, the grocery clerk may choose to avoid work. If that happens, there will be less food available for other players. The goal is to encourage players to reflect on how one person's actions affect other players in the simulated community.

While it would be misleading to suggest that playing a simple game can let players know what it's “really like” to confront the impossible decisions real world workers face when forced to choose between their health and their livelihood [2], experiential engagement with these problems can at the very least serve to augment players' understanding, adding multiple perspectives to real world crises [8].

In order to emphasize these moral dilemmas, *Essential Workers* drew inspiration from playable simulations (digital) and board games (digital and analog).

The digital works that most influenced our designs were Nicky Case's browser-based Explorable Explanations, which use a combination of text and interactive simulations to persuade the reader on social and civic issues. For example, *What Happens Next?* [10] is a series of sandbox simulations about the COVID-19 pandemic. Case's essential tactic is that of an essayist: posit a thesis, support it, and walk the player to a conclusion. The single player version of our game is directly inspired by this approach and guides the player through the pandemic experience day-by-day much like a tutorial. In contrast, the multiple player version asks players to learn through emergent gameplay—that is, outcomes discovered by a game's players that weren't explicitly planned by the creators.

Other epidemiology-based games also inspired us. For example, the online simulation *People of the Pandemic* [14] uses actual data from other players in your area to give a sense of local participation and interdependency, packing an impressive array of visualizations into a highly usable interface. In contrast to this piece, our design aims for the player to feel that they are a specific individual in the pandemic who is forced to make not-always-ideal choices in response to the conditions of their role—as a nurse, a delivery driver, or whomever they may be. The roles themselves owe inspiration to the 2008 analog board game *Pandemic* [4]. The game's cooperative play between archetypal roles (e.g. scientist, quarantine specialist, and dispatcher) collectively depict a community spirit. This community-minded ethos is reflected in *Essential Workers*, linking individual struggles with the macro-level effects of a pandemic.

Table 1: Sample of Dilemma Design Document

Infected	Health (Food)	Wealth	Job Security	Description
No	Low (Food = 0)	Fine	Low	DILEMMA. It is the peak of the pandemic. You are out of food and your health and job security are low. Do you stay at home and order food? Or do you risk infection and go to work and finish your remaining shifts to ensure you are not furloughed?
No	Low (Food > 0)	Low	Fine	NO CHOICE. It is the peak of the pandemic. Your health and wealth are low. You must risk infection by going to the grocery store and working so that you get enough wealth to make rent this week.
No	Low (Food = 0)	Low	Fine	LOSE. Your health, food, and wealth are low. You must go to the grocery store to work so that you get enough wealth to make rent this week. You also need to spend wealth to buy food so that your health doesn't drop to zero this turn. Since you need to do both, but can only do one on this day, you will lose by the end of the turn.

4 PROTOTYPING AND PLAYER FEEDBACK

A primary design goal for *Essential Workers* is to highlight how a player's individual decisions affect the community. The optimal strategy in *Essential Workers* is to cooperate and collectively minimize risk. We observed play-testers coordinating their schedules in order to avoid unnecessary contact. For instance, one play-tester proposed talking about when players wanted to go to the Grocery Store to buy Food so that they could “take turns” and avoid crowds.

However, players lamented the lack of additional cooperative mechanics. One participant proposed implementing an in-game trade mechanic to help players share resources. While many players felt the strength of the game's design lay in the interrelationships among the players, they also felt these relationships needed to be made more transparent.

Another goal of the game was to highlight how the state of the community can affect individual player's actions. The SIR graph aimed to inform players' decisions by showing them how many people were infected in the city. However, most play-testers found it difficult to read the graph itself and often did not consider it in their decision-making process. Players only realized the true extent of the infection in their community when it was visualized by the state of infection of the “background” population accompanying them, after they had already made their decision.

The team also tested other mechanics and dilemmas in earlier iterations of *Essential Workers* (see Table 1) such as a Job Security mechanic. Players needed to work enough shifts each week to maintain a high Job Security value, and players with too low a Job Security value would become unemployed and be unable to obtain Money. However, playtesting showed this mechanic did not uniquely motivate players to work and created frustration by limiting players' actions and engagement with the game.

An early version of *Essential Workers* also implemented a system of symptoms and testing. Players would be notified of general symptoms such as “mild headache” or “sore throat” rather than being notified if they contracted the virus. Players could then go to the Hospital to get tested, and the results of the test would be returned after two in-game days. The system was intended to educate players on existing testing efforts, but ultimately proved

too confusing. Many players felt it did not contribute to the game's overall goal of cooperation.

5 NEXT STEPS

Originally designed as a multiplayer-only title, *Essential Workers* began development as a prototype entry in the 2020 ComplexityJam organized by Interactive Narrative Design for Complexity Representations (INDCOR). While the game was recognized as “most promising for further development,” we received constructive feedback from the judges that is being factored into the next version of the game.

In order to fine-tune the cause and effect choices, make them more visible to players, and emphasize choices that provoked moral dilemmas and foregrounded interdependencies, we decided to focus the next stage of development on refining the single-player game. That shift in focus provides an opportunity for new mechanics such as a limited grocery supply when the grocery clerk is sick or greater health benefits when the nurse is present at the hospital.

The current single-player prototype focuses on the grocery worker as the active player role, and we plan to implement variations on the single-player game using all four of the roles. We will conduct five stages of user testing. First, we will do iterative formative testing for each of the four single-play games, then we will deploy an updated multiplayer version. We will evaluate the game based on the coherence of the gameplay and how well it communicates the model of interdependency.

We believe that games show great promise in illustrating the entanglements between individuals and complex social systems. However, finding the right level of abstraction to represent individual actions within a collective situation takes iteration and tuning. We hope that our work on this game will contribute to developing a vocabulary for thinking about the components and design goals of such explanatory games.

ACKNOWLEDGMENTS

The Digital Integrative Liberal Arts Center at Georgia Tech, and this research, are funded by a generous grant from the Andrew W. Mellon Foundation.

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