

TEACHING THE BLACK DEATH WITH SYSTEMS THINKING

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Winston Churchill suggested that "history unfolds itself by strange and unpredictable paths,"¹ but however that might be, too many students of history tend to view the unfolding as a disconnected series of events, or perhaps worse as a mere collection of facts. Over the past several years I have introduced a different method of teaching history concepts in a variety of course settings, as well as in presentations to groups. This method involves systems thinking or understanding how events are related to and influence each other and combine in series and feedback loops to create very complex patterns. I propose that it is the identification and understanding of these patterns that make history useful in understanding the past, dealing with the present, and planning for the future. In this paper I describe how system mapping can be used to clarify the events of the Black Death in Europe and I provide some sample "maps." (The four figures in the essay are examples from students maps.)

Systems Thinking: Seeing the Connections

The modern versions of systems thinking are usually traced to the 1940s in the works of Ludwig von Bertalanffy on conceptualizing interconnected biological processes and Norbert Weiner on cybernetics involving feedback and control mechanisms.² This interconnected view of historical events adds a richness and sense of mystery that can stimulate the curiosity of students. The central idea underlying systems thinking is that events are not discrete occurrences in themselves, but are simply notable points in what are complex chains of events. These links might be causal or merely sequential. Furthermore, many of these are not necessarily a linear unfolding, but involve feedback and feedforward loops that continue to modify the events, sometimes subduing them, sometimes accelerating them. System maps can be very complex, but the simple ones presented here are sufficient for the purpose.

One example of a feedback loop is the effect of the increasing population on several aspects of medieval life that in turn feedback to check growth. In spite of earlier famines, the population of Europe was at its peak at the time of the plague. With a decreasing amount of workable land, the passing of land from father to sons left each with increasingly small parcels. As a result, inheritance changed so that only the eldest

¹Winston Churchill, *A Churchill Reader*, Colin R. Coote, ed. (Boston: Houghton Mifflin, 1954), 394.

²Ludwig von Bertalanffy, "An Outline of General Systems Theory," *British Journal for the Philosophy of Science* (1950), 1:139-164, and Norbert Weiner, *Cybernetics or Control and Communication in the Animal and the Machine* (Cambridge, MA: MIT Press, 1948).

son received a parcel and the others more often left for towns to seek work and independence. Since establishing themselves in new trades took some time, they could not support families and tended to wed later or not at all, which then lowered the birth rates for these areas.

Systems thinking was promoted popularly in the James Burke 1979 PBS television series, *Connections*, and the companion book.³ In the programs, Burke focused on apparently serendipitous historical events that led to major modern developments in technology. Instead of looking at single events in isolation, the relationships among events over time were emphasized. In our simulation, for example, the origins of the Black Death were in Mongolia, where an increasingly inhospitable dry climate forced animal herders (whose animals had been infected by plague-ridden marmots) to go south, where they exposed migrating Mongol warriors to the disease. As the Golden Horde expanded its influence throughout China and India, and eventually to Kaffa in the Black Sea region, the plague followed. Owing to recent developments in improving ship design and speed, the Genoese traders escaping from Kaffa spread it to Southern Europe when they reached Italian ports.

Designing an Effective Simulation

Learning is most effective when learners are exposed to realistic situations where they can use more of their senses to make the information more meaningful and personal. Brian McKenzie has noted how the availability of online resources matches the popularity of this media for the new generation of learners.⁴ There are many qualities of a simulation that make for an effective learning experience. Immersibility in the experience is an essential feature in which the learner considers the simulation realistic and engaging. This is facilitated by a multi-sensory interface so that the learner is visually, auditorily, and kinesthetically involved. A compelling, organized, and realistic story line allows the learner to follow the chain of events logically as the story unfolds.⁵ Perhaps most importantly, the reflective learning cycle is engaged, in which

³James Burke, *Connections* (Boston: Little Brown & Company, 1978).

⁴Brian McKenzie, "Simulations, Sources, and the History Survey Course: Making the Internet Matter," *Teaching History*, 30 (Fall 2005), 82-90.

⁵David X. Swenson, "The Deep Dive: Teaching Systems Thinking with Immersive Simulation Gaming," Presentation at "Classrooms of the Future—XI," The College of St. Catherine, St. Paul, MN, May 24, 2005.

the learner first reflects on what has been observed, then interprets what the observations mean, and finally draws conclusions and generalizations based on them.⁶

The Structure of the Black Death Simulation

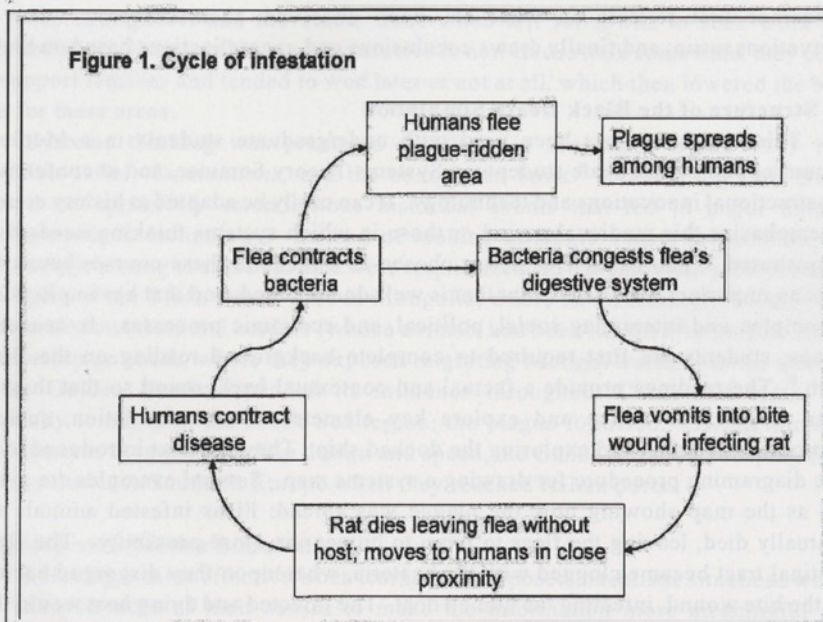
This simulation has been used with undergraduate students in a Medieval Economics course, graduate students in Systems Theory Seminar, and at conferences on instructional innovations and technology. It can easily be adapted to history courses that emphasize this medieval period or those in which systems thinking needs to be demonstrated.⁷ The Black Death was chosen as a focus in these courses because it offers an important historical event that is well-documented, and that has implications for complex and interacting social, political, and economic processes. In academic courses, students are first required to complete background reading on the Black Death.⁸ The readings provide a factual and contextual background so that they are better prepared to notice and explore key elements of the simulation, such as questioning the priest and exploring the docked ship. They are next introduced to the basic diagramming procedure for drawing a systems map. Several examples are given, such as the map showing how the plague was spread: Fleas infested animals that eventually died, leaving the fleas to jump to humans in close proximity. The fleas' intestinal tract became clogged with the bacteria, whereupon they disgorged bacteria into the bite wound, infecting the human host. The infected and dying host would then infect more fleas and pass them on to other humans in the family or while attempting to flee the plague-ridden towns (see Figure 1).

The simulation is designed into three situations for system mapping: the preconditions that led to the plague, coping with the plague, and changes influenced by the plague. The class is divided into teams of three to five students each who explore the simulated medieval world, return to present day to draw systems maps, and discuss the implications of the patterns they discover.

⁶David A. Kolb and Roger Fry, "Toward an Applied Theory of Experiential Learning" in C. Cooper, ed., *Theories of Group Process* (London: John Wiley, 1975), 33-57.

⁷An online simulation is also available for middle school students by Cory W. Wisnia, "The Black Plague: A Hands on Epidemic Simulation—A Pilgrimage during the Time of the Black Plague," http://www.mcn.org/ed/cur/cw/Plague/Plague_Sim.html.

⁸Students are required to read William Naphy and Andrew Spicer, *The Black Death: A History of Plagues* (Charleston, SC: Tempus, 2000). A more recent publication by John Kelly, *The Great Morality* (New York: Harper Collins, 2005), is an excellent alternate book. Elizabeth Lehfeldt's *The Black Death* (Boston: Houghton Mifflin, 2005) presents several differing viewpoints.



Each team member separately logs on to the simulation and is teleported in time back to an English town about the year 1350 to explore the medieval world individually. The storyline of time-travel is based on an actual physics experiment conducted to test the feasibility of particle teleportation.⁹ Students take the role of an investigator who is recruited to personally explore the circumstances surrounding the Black Death and consider parallels to modern crisis situations. The exploration usually takes two to three hours, but there is no time limit. During their adventure, students keep notes on their observations and how events might be related to each other.

This simulation was designed using the gaming engine from the multiplayer online game, *Neverwinter Nights*.¹⁰ This commercial computer game involves fantasy role-playing set in a quasi-medieval period, in which the user creates a character who can be directed through a rich graphic 3-D environment to interact with other characters to solve problems. The game editor (an authoring tool for designing customized settings) enables an instructor (even a self-taught semi-programmer as myself) to design

⁹Anthony Sudbury, "Instant Teleportation," *Nature* (1993), 362, 586-587. Although this kind of research sounds like science fiction, several studies of this kind have been funded. This kind of speculative research helps students suspend belief as they enter the simulation.

¹⁰*Neverwinter Nights* (Bioware Corp), <http://nwn.bioware.com>.

a medieval countryside and small-town scenario, complete with buildings, wandering animals, weather conditions, sound effects, and inhabitants. These objects can be dragged and dropped on a landscape for countryside and town layout. The inhabitants are drawn from a large database of males and females, dressed in a variety of clothes, from finery to rags. These characters can be programmed fairly easily to engage in interactive dialogues with players using a decision-tree structure. That is, the game character will present a series of possible conversation options that the player chooses, thereby taking the player down a chain of conversation topics. In addition, the player can enter and explore the buildings and docked ships, observe the chaos of the plague, and even read ship records and personal journals documenting its impact and progression. Travel routes down streets and across fields can be set for wandering people and animals to portray the dynamic nature of the simulation. The range of sounds can be set so that pleading inhabitants locked in houses can only be heard when close to a door, with the sound of harbor waves or calls of townspeople able to be heard for some distance.

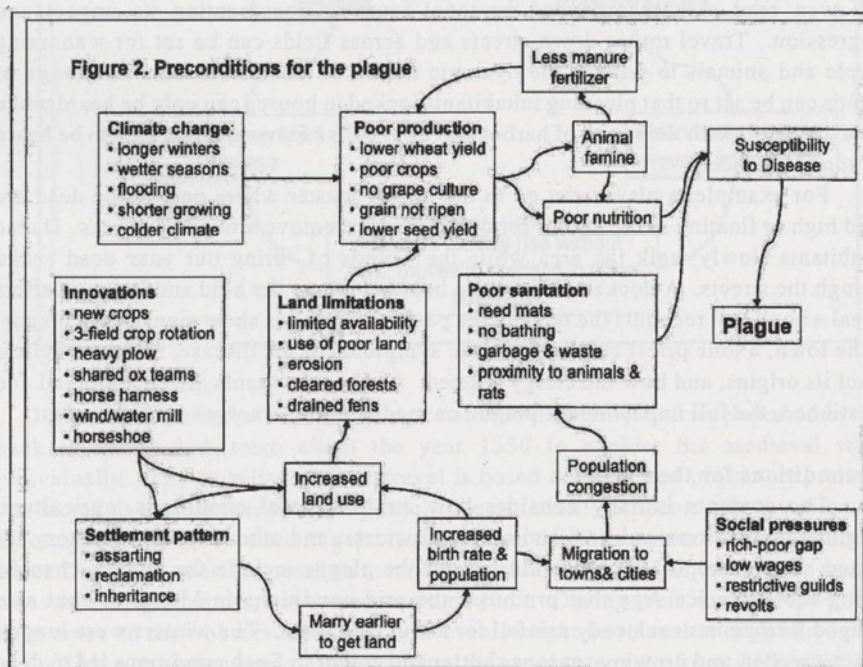
For example, a player can go to the harbor master where nearby the dead are piled high or floating in the harbor for disposal, as rats move around the docks. Dazed inhabitants slowly walk the area while the sounds of "bring out your dead" echo through the streets. A docked ship can be boarded where the hold and living quarters reveal a book that recounts the terrible sea passage as sailors show signs of the plague. In the town, a lone priest can describe the symptoms of the disease, religious beliefs about its origins, and how the clergy reacted. As the inhabitants are encountered and questioned, the full impact of the plague on medieval life emerges for the student.

Preconditions for the Plague

The students initially consider how environmental conditions, agriculture, technical innovations, political and social structures, and other aspects of history are related. For example, the preconditions for the plague include the climate changes during the Little Ice Age that produced the arid conditions in Mongolia, but also deluged Europe in near steady rainfall for about five years. The winters were longer, seasons wetter, and growing seasons shorter and colder.¹¹ Such conditions led to dead seedlings, heavy-headed cereal crops breaking under the rain and rotting in the fields, rich soil being washed away, and muddy fields being bogged down to plowing. The emphasis on a single wheat crop led to lower wheat and seed yield, which starved both livestock and humans and left both more susceptible to ill health. Earlier innovations in farming technology such as the heavy plow, horse harness and shoes, and three-field planting, as well as smaller land plots and extensive assarting or land reclamation, initially made the land more productive, but eventually stressed the land beyond its

¹¹Brian Fagan, *The Little Ice Age: How Climate Made History, 1300-1850* (New York: Basic Books, 2001), 28-32, 80.

productive limits.¹² Under a patrilineal system, land was usually inherited by the eldest son, leaving little for other children. Consequently, most young men migrated into towns where the population became more congested. Hygiene was poor at best: bathing was difficult since water was usually contaminated by sewage runoff, and foul body odor was sometimes covered with herbs or perfumes. Families often housed livestock on the first floor, while they slept above them. High population density, exposure to garbage and waste, rare bathing, and proximity to animals and rats created the contagion factors required for the plague to spread¹³ (see Figure 2).



Coping with the Plague

Medieval people had no understanding of the microorganism origins of the plague, and they relied on their beliefs, often mistaken understanding of medicine.

¹²Robert S. Gottfried, *The Black Death* (New York: Free Press, 1983), 16-32.

¹³John Kelly, *The Great Mortality*, 16-17; R.S. Bray, *Armies of Pestilence* (New York: Barnes & Noble, 1996), 65.

Prominent among these were the beliefs in the role of bodily humors, or fluids, astrology, and miasma or foul smells contributing to illness. Coping with the rising death toll, they desperately used their limited medical and herbal knowledge, mysticism, religious piety, and blaming of others. They initially relied on traditional methods of healing such as purging, bleeding, and cauterization, as well as herbal remedies, such as sprinklings with rose water and vinegar, dustings with myrrh and saffron, and consumption of garlic and leeks. Cannons were fired and church bells rung in an attempt to drive off the miasma. Prayer, excessive piety and devotion, and group hysteria, such as the flagellants who marched from town to town (also transporting the plague) imitating Christ's suffering by beating themselves with scourges, were relied on—all to no avail. In many countries, the mistrust of strangers and those who were different led to attributing the plague to Jews, Muslims, heretics, homosexuals, prostitutes, lepers, vagrants, foreigners, refugees, and the poor; many were beaten and driven out of towns, some were collectively burned.¹⁴ When all else failed, they often fled, as in Boccaccio's *Decameron*,¹⁵ leaving behind their families and taking the plague with them to uninfected communities.

An understanding of the infectious nature of the plague gradually developed. However, in some instances contagious vectors were misunderstood, as in London during a later plague, when author Daniel Defoe reported that more than 40,000 dogs and 200,000 cats were exterminated.¹⁶ Nonetheless, effective methods were discovered or expanded, such as use of quarantines, passports, and health and death certificates. Bathing became more popular, as did garbage removal, fumigation, and segregation of infected corpses¹⁷ (see Figure 3).

Changes Influenced by the Plague

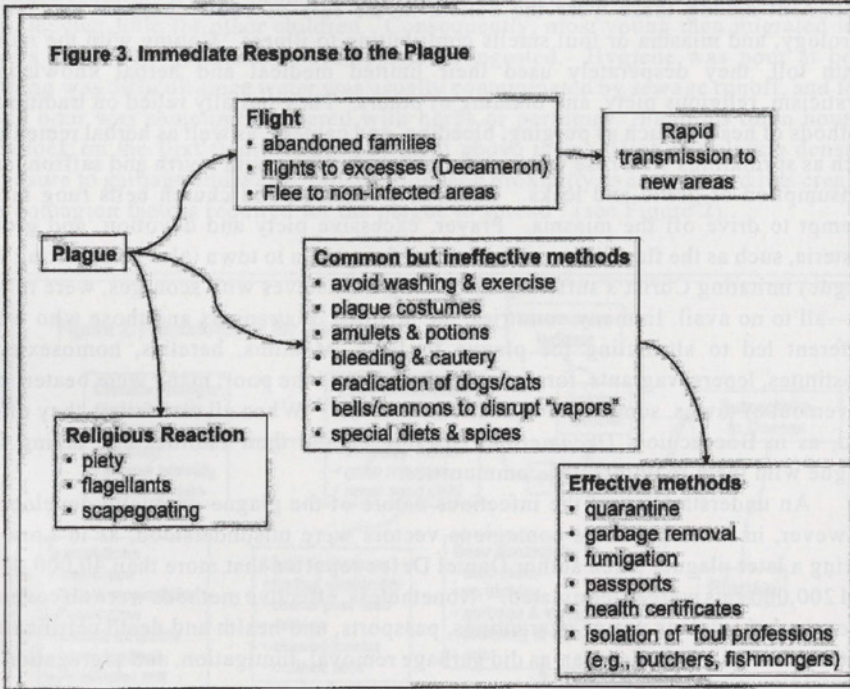
The linking of the immediate devastating impact of the plague to the longer-term consequences is an especially important part of the discussion. For example, the plague had an impact on most of the social structures of European society. The decreased population resulted in a smaller work force that lowered industrial production and required innovations, such as expansion of mining methods and salting fish. It also created a sense of urgency in people's lives such that work patterns changed: There was

¹⁴David Nirenberg, *Communities of Violence: Persecution of Minorities in the Middle Ages* (Princeton: Princeton University Press, 1996), 231-33, 236-45; Philip Ziegler, *The Black Death* (New York: Harper & Row, 1969), 97-109.

¹⁵Giovanni Boccaccio, *The Decameron*, G.H. McWilliam, translator (Penguin Classics, 2003).

¹⁶Daniel Defoe, *A Journal of the Plague Year*, Project Gutenberg, <http://www.gutenberg.org/dirs/3/7/376/376.txt>.

¹⁷Naphy and Spicer, 75-80.

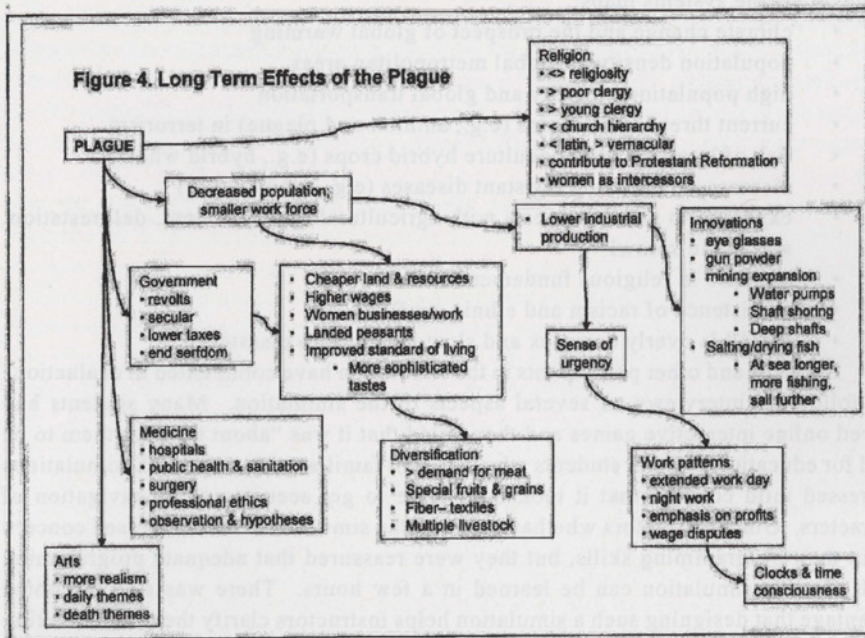


more emphasis on profits and wages and greater time-consciousness and use of clocks. The smaller workforce also enabled more people to own land, demand higher wages, and improve the standard of living, and it allowed common people to develop more sophisticated tastes. As a result, production responded to demand by diversifying foods and textiles. The role of women was also affected by the plague: For example, during the devastation of the clergy, many women were allowed to perform sacraments and provide medical care.¹⁸ They also entered higher wage jobs, took over family businesses, and acquired land.

There were also changes in institutions. For example, there were compromises in religion resulting from the high percentages of clergy deaths. More young, poor, and less educated men entered the clergy, and much of the Latin used in conducting Masses

¹⁸Ibid., 39.

was dropped in favor of the vernacular.¹⁹ Government became increasingly secularized, taxes were lowered, and serfdom—in steep decline by the time of the Plague—effectively ended since more people now owned land and could command their own wages. Although there were efforts by the ruling classes to limit wages and restrict commoners from displaying newly acquired wealth, such efforts were overturned and some consider that it contributed to the Peasants' Revolt and other insurrections.²⁰ The arts reflected the devastation of the plague, expressing themes of daily life, realism, and mortality. The *Danse Macabre* or Dance of Death is one such popular piece depicting Death in the form of a dark figure leading a line of people across a wasting landscape. Finally, medical changes emerged in the form of public health and sanitation boards and regulations, medical libraries, professional ethics, and a much improved scientific method. Hospitals still segregated ill persons but shifted emphasis to healing rather than merely warehousing the prospective dead²¹ (see Figure 4).



¹⁹David Herlihy, *The Black Death and the Transformation of the West* (Cambridge: Harvard University Press, 1997), 71.

²⁰Kelly, *The Great Mortality*, 16-17.

²¹Gottfried, *The Black Death*, 16-32.

Discussing the Simulation

After students have explored the medieval town and surrounding area, they exit the simulation to consolidate and discuss their findings. They usually begin by each telling their own version of the trip, and they identify the significant incidents and facts of the situation that they write on 3x5 index cards. The cards make it easier to lay them out on a large table or pin to a storyboard as students begin to build sequences and connections. The same can be done with chalkboard or newsprint and markers. When complete, the systems maps are drawn more carefully and presented by each team to the rest of the class. Finally, a composite for the class is constructed from each of the team maps.

The last portion of the simulation focuses on a discussion of the systemic patterns and their implications for understanding current and emerging events. The possible interactions among the following modern conditions are discussed in light of the medieval plague systems maps:

- climate change and the prospect of global warming
- population density of global metropolitan areas
- high population mobility and global transportation
- current threat of biotoxins (e.g., anthrax and plague) in terrorism
- risk of large scale monoculture hybrid crops (e.g., hybrid wheat)
- increase of antibiotic resistant diseases (e.g., tuberculosis)
- exposure to new biothreats with agricultural encroachment, deforestation, and urban sprawl
- increase in religious fundamentalism
- persistence of racism and ethnic conflict
- FEMA's overly complex and slow response to disasters

Students and other participants in the simulation have commented in evaluations and follow-up interviews on several aspects of the simulation. Many students had played online interactive games and they noted that it was "about time for them to be used for education." Other students who were not familiar with online 3-D simulations expressed mild concern that it took more time to get accustomed to navigation of characters. Other instructors who have viewed the simulation have expressed concern about their programming skills, but they were reassured that adequate programming skills for this simulation can be learned in a few hours. There was also the noted advantage that designing such a simulation helps instructors clarify their own thinking about the historical details and how to present them.

Most often, students and other participants reported that the realistic online simulation, use of team discussion, and building systems maps has changed many aspects of their thinking. Rather than seeing isolated facts, systems mapping encouraged them to see connections among events. They reported that the realistic landscape, branches of interactive dialogue, and ability to explore the buildings and surroundings made the experience more immersive for them and more personally

meaningful. In their group and class discussions, many commented with surprise how similar the dynamics of this medieval period are to our current issues of concern over population congestion, climate change, and potential epidemics. The use of systems mapping also takes the rather long and complex readings and translates them into imagery that is clearer. They most often mention that their curiosity has increased when reading history and current news, asking themselves, "I wonder what this is connected to?"