# Black Plague – The Spread of Disease:

## An Historical Model

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### Introduction

This model seeks to represent the black plague (1348-1350) and show the process of infection based on the conditions at the time (i.e. medical, societal, etc.) in Medieval Europe. The hope is that it would accurately represent how the plague would have unfolded, more or less. The black plague is the name given to a time in Europe where tens of millions of people died as the result of a violent disease unknown at the time.[1] There was virtually nothing that could be done for the people who suffered and most died horrific deaths. This model seeks to grasp at least a bit of the plague and how it may have unfolded.

### Setting the Variables

- Let the population be 1000 people
- People infected and healthy:
    - Let the amount of healthy people (not sick with plague) be "98%"
    - Let the amount of carriers (sick with plague) be "2%"
- Infection Rate: Let each carrier infect "85%" of people they come into contact with
- Immunity: Let the percentage of population immune be "5%"
- Recovery: Let the chance of recovery for those infected be "30%"[2]
- Each carrier has one turn in which they can only come into contact with 5 people (carriers or healthy) before they either die or recover

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[1] http://www.eyewitnesstohistory.com/plague.htm

[2] 30-60% of Europeans killed by plague - *A pest in the land: new world epidemics in a global perspective* By Suzanne Austin Alchon

## Information and Reasoning for the Model

This model would be used in a program like Netlogo. Therefore I decided to set the population at 1000 people – the number being representative of the European population during the Bubonic Plague of 1348 -1350. Thus, the historical process I chose to represent here was the spread of disease, specifically the case of the plague in Medieval Europe. The numbers are based on the conditions of the time (i.e. unsanitary conditions, lack of any germ theory, and very little/primitive means of health care – relative to us – would ensure that infection rates were very high among the population). These conditions would be the perfect breeding ground for bacterial infections or the spread of diseases and viruses. The starting point would have only a very small amount of the population infected. This is why I chose "2%" of the population. The amount of healthy people just means people who are not infected by the plague. This number is one of the reasons models can lack in representing history – these people considered "healthy" would be in poor living conditions, have a short life span, and many would get sick and/or die from simple diseases that nowadays would be just a minor annoyance to most people. Thus, we must realise that here, "healthy" means not infected with the plague.

The number of people the carriers of the disease can come into contact with is "5" and then they either die or live (based on the 30 / 70 chances given at the end of their turn). I chose "5" because these people would have come into contact with other people in their villages. With this, "85%" is the rate of infection.

The percentage of immune (meaning they either were lucky enough not to contract the disease or are actually physically immune) is "5%". The percentage of immune people is so low because of the conditions at the time (as stated above, room has to be left for those with a natural immunity and the "lucky" ones).

## How the model works

Now that we have the numbers and figures described, it is time to move on to how the process works. The model would have the people represented as dots. The healthy people would be green dots and the carriers (infected) would be red dots. Here's how it would work:

1. When the model starts, there would be the 1000 dots: "2%" red and "98%" green.

2. The dots would then move around and come into contact with each other at random
    a. If a carrier comes into contact with a healthy person, that person has an “85%” chance of becoming infected (i.e. a red dot). They then move on to contact others.
    b. If the healthy person is not infected, they stay as a green dot and then move on and contact others.
3. Once the carrier has come into contact with 5 other dots (red or green), they have a 30% chance of recovering
    a. If they do not survive, they turn to grey dots and do not move (they can also not be contacted by other dots still alive – they are just there to show they are dead. Theoretically, they could still contact and infect healthy people but for our sake, let them be neutral)
    b. If they recover they turn green and continue on moving and coming into contact with other dots
4. The immune population keeps moving around and cannot be infected ever
5. The model ends when there are either no more carriers (i.e. red dots) or only immune people left
    a. The model then tell you a history of what happened

## Conclusion

The hope is that such a model, if actualised, would more or less represent how the black plague would have played out – if only quantitatively. Given my lack of computer programming background and my schedule, I decided to sketch a model rather than program one in Netlogo (I’ve seen though that there is a model for infection, AIDS, etc.) They would all be more or less the same except for the specifics). Computer models are a great way to represent history and try to visualise an historical process. As I said above though, there are some limitations such as saying that a person was “healthy” then, does not by any means mean that today they would be considered healthy. Also, it is difficult to get the view of what the plague was like by just “looking a numbers” as it represents nothing about the impact of the plague on religion,

society, culture, etc. That being said, this model would be helpful – although very simple (a more complex one would yield great results) – because of such reasons that records were not and could not be very well kept back then so we do not have specific numbers of deaths. A computer model like this would represent that quite well and the best part is that it can be run as many times as you want and each time you get a different outcome. This would yield great results. Any type of process that can be actualised to advance our understanding of history should be studied and models are a great way to understand certain aspects of history.