ACTISS
ACTION FOR COMPUTATIONAL THINKING
IN SOCIAL SCIENCES

INTRODUCTORY COURSE

People, Networks and Neighbours:
Understanding Social Dynamics

MATERIALS FOR WEEK 3

Neighbours, flags and a bird's eye view

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Neighbours, flags and a bird's eye view

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OVERVIEW OF THIS WEEK'S MATERIALS:

This week introduces spatial dimension to the models, we introduce the term Agent-Based Models and play with a simple simulation in NetLogo. We investigate how a protest may spread spatially with simple cellular automata (we don't use this term but it should be searchable by that term), show real-life examples of models and then wrap up all the course's activities.

Keywords: social dynamics, spatial models, neighbours, cellular automata, Agent-Based Models, ABM, NetLogo, social simulation, emergence, computational social science, computational models.

STRUCTURE OF THIS WEEK'S MATERIALS:

Protests that spread spatially
In this activity, you will consider how sometimes protest comes in a 'spatial' form and consider how some processes may spread via neighbour-to-neighbour influence.

STEPS:

- The protests that spread spatially – VIDEO (02:14)
- Garden and decoration fashions – DISCUSSION

Protests in Cherryville
In this activity, you will investigate a model of a process that spreads in space and we will focus on the process of creating this model, both by looking at individuals and their surroundings.

STEPS:

- The protests in Cherryville – VIDEO (02:42)
- Making decisions when creating a model – ARTICLE
- How does the Cherryville protest work? –QUIZ

Spatial protests seen from a bird's eye view

In this activity, you will explore the model further, this time on a bigger scale and you will see the results of the process from a bird's eye view.

STEPS:

- Experimenting with Cherryville protests – ARTICLE
- Questions about Cherryville experiments –QUIZ

Simulating the spread of the protest in different cities

In this activity, you will experiment with different cities with the help of a simple simulation tool (no need to install anything!) and you will observe how protests spread depending on different initial conditions.

STEPS:

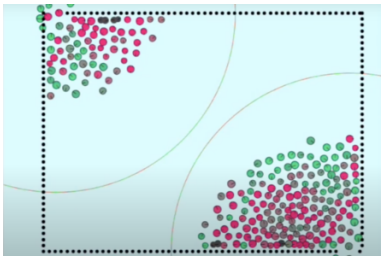
- Introduction to NetLogo – ARTICLE
- Simulation of the Cherryville protest – EXERCISE
- Are the initiators encouraging their neighbours? – EXERCISE
- How do thresholds influence the spread of the protest? – EXERCISE
- Do lower thresholds make protests grow faster? – EXERCISE

Combining the number of initiators and level of threshold.
In this activity, you will first investigate how both the number of initiators and the average threshold level impact the final patterns and afterwards we will sum up the results of all experiments.

STEPS:

- Changing multiple parameters – EXERCISE
- Simulation exercises – QUIZ
- Initiators and protests –DISCUSSION
- Protests that spread spatially –ARTICLE

Agent-Based Models
In this activity, you will learn about agent-based models (ABMs) - on the basis of spatial protest simulations - and explore some real-life applications of those models.

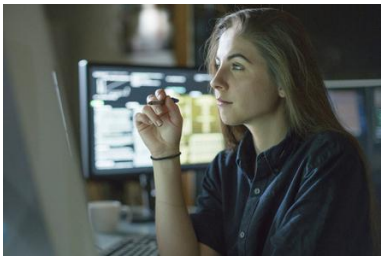


STEPS:

- Agent-based models – ARTICLE
- Agent-based models in practice – ARTICLE
- Formulating a model wishlist – DISCUSSION
- Can modelling and simulation help in making decisions? – VIDEO (03:50)

People, networks and neighbours: summing up

You have reached the end of this course. Thanks for participating! In this activity, we will quickly wrap up the contents of the whole course and point to some directions on how you can study computational models further.



STEPS:

- Complex social processes and computational models – ARTICLE
- What next! – ARTICLE

EDUCATIONAL MATERIALS

1. The protests that spread spatially - VIDEO

Welcome back! This week introduces spatial dimensions to the models. We will also introduce the term Agent-Based Models and interact with a simple simulation in NetLogo. Furthermore, you will investigate how a protest may spread spatially and look at some real-life examples of models. Finally, we will wrap up all the course's activities and point to what to do next in order to learn more about modelling and simulations.

Click on video to view the trailer

In this video, we will discuss how protests sometimes have a 'spatial' form and may spread by neighbour-to-neighbour interaction and we will present some examples of such protests.

2. Garden and decoration fashions - DISCUSSION

Garden © Arno Senoner on Unsplash

There are many processes that spread spatially. It is definitely not only restricted to protests! Let's think about fashions related to our places of residence. Let's face it, what we see behind the neighbours' fence matters. However, it is also not without reason that all magazines about furnishing flats, houses and gardens are so popular.

Of course, part of the inventiveness and habits of the inhabitants are sometimes limited by external regulations concerning decorating a house or maintaining a garden in certain tourist areas.

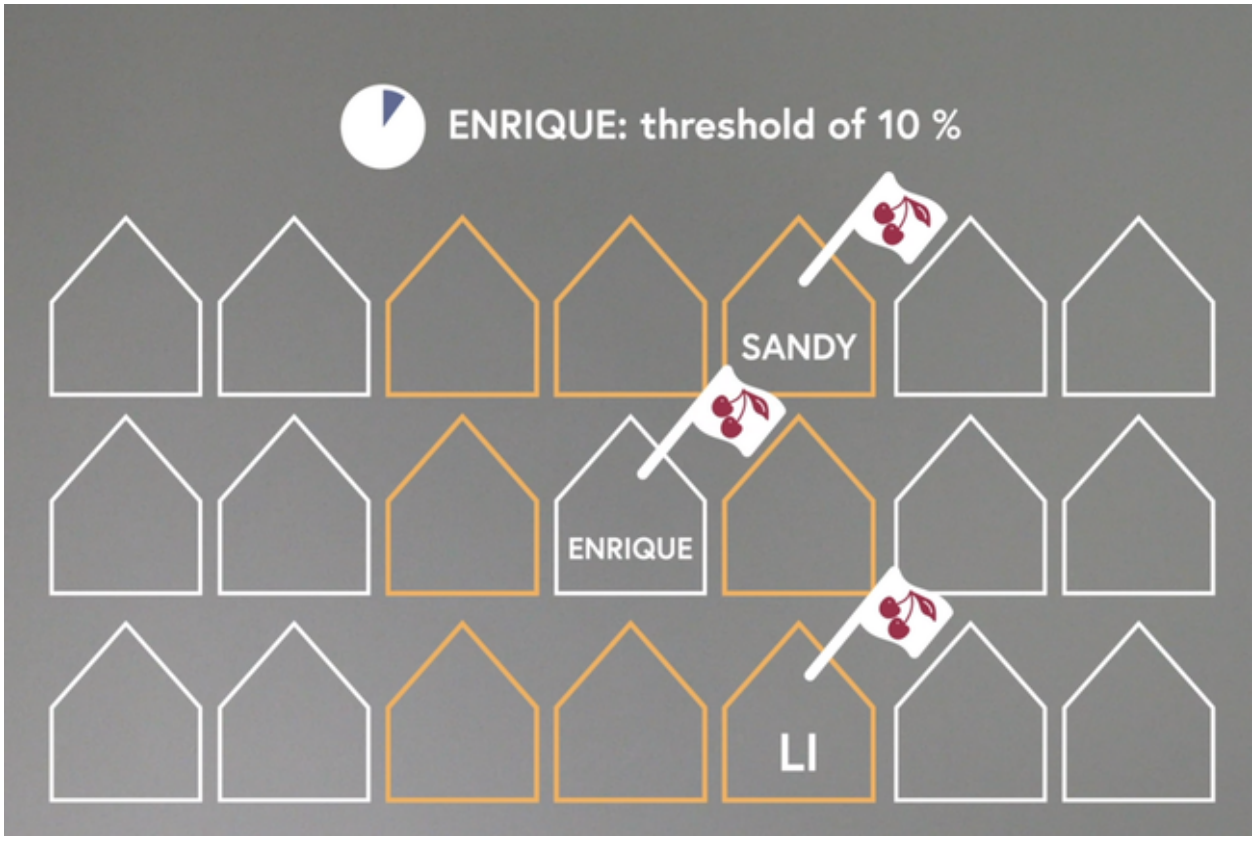
Can you think of any fashions related to designing gardens or decorating your house, door or balcony? Do you think there is imitation going on there? Why or why not?

3. The protests in Cherryville - VIDEO

In this video you will meet the inhabitants of Cherryville and you will accompany them in their protests. Then we are going to describe the spatial model developed in order to study this protest.

Click on video to view the trailer

4. Making decisions when creating a model - ARTICLE

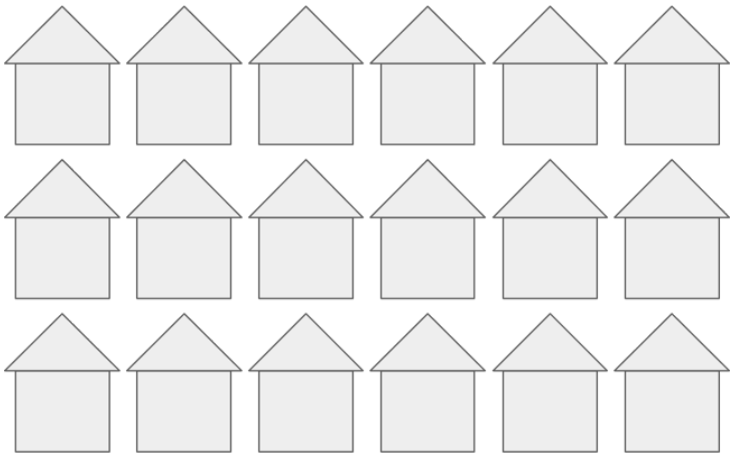


Houses and inhabitants of Cherryville © ACTISS

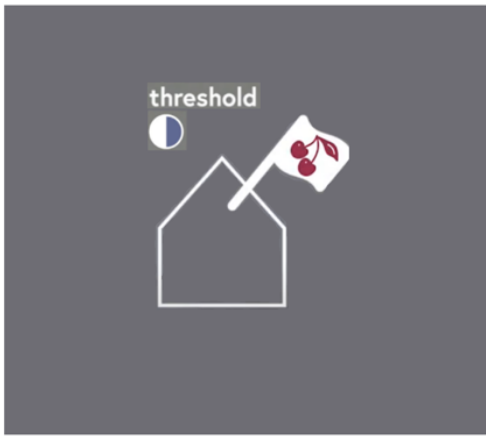
In this article, we are going to describe the model developed in order to study the Cherryville protest in more detail putting stress on the process of modelling itself.

Now we are going to systematise the description of a model ordered by Cherryville authorities in the context of your knowledge about modelling. As we said before in the process of modelling we need to make several assumptions about reality and choose which elements are important from our point of view.

What does it look like in the case of a model of protest in Cherryville? An expert probably started from the construction of the village. She decided that it would have the shape of a rectangle and it would be divided into small squares, which makes it similar to a chessboard. In every square, there is one house (with one citizen).

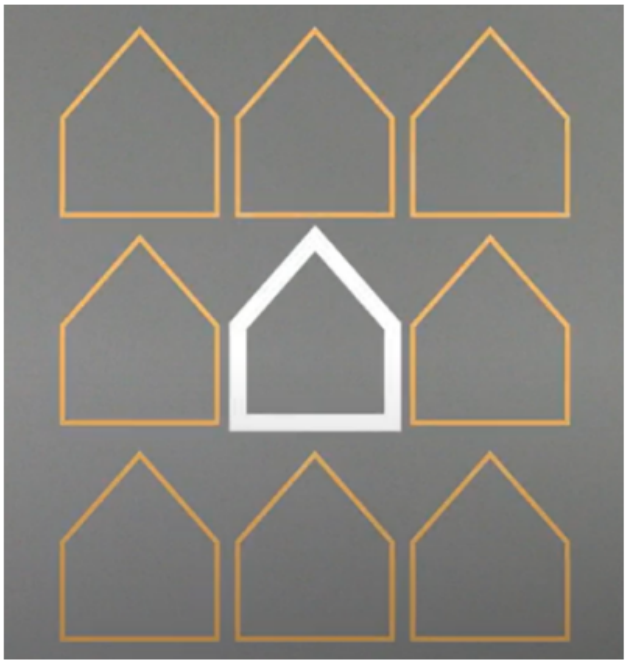


What about Cherryville citizens? We are sure that you noticed that they don't have many features, which real people have. What features do they have and what can they do? People in the model live in their houses, they have a specified threshold and they are protesting or not. "To protest" in practice means to hang a flag on their house, which means that on every house there can be a maximum of one flag.



That is all - not a lot, don't you think?

There is one more assumption of our expert, which is quite important in all models which illustrate processes that spread spatially. It is an assumption about a neighbourhood. Every place on the chessboard is surrounded by another 8 places. It means that every house can have 8 neighbours.



And when a resident who is in the center of such a neighbourhood decides to protest or not, he will take into account the situation in those houses according to his threshold. When the percentage of neighbours who protest is equal or higher than this resident's threshold he or she will also hang a flag. Otherwise, the resident will not do it. And exactly the same thing will happen with all other citizens of modelled Cherryville - each of them is looking at his or her neighbours, comparing the percentage of houses with flags with his/her threshold and making a decision about joining a protest.

As you can see several decisions were made in the process of creating the model:

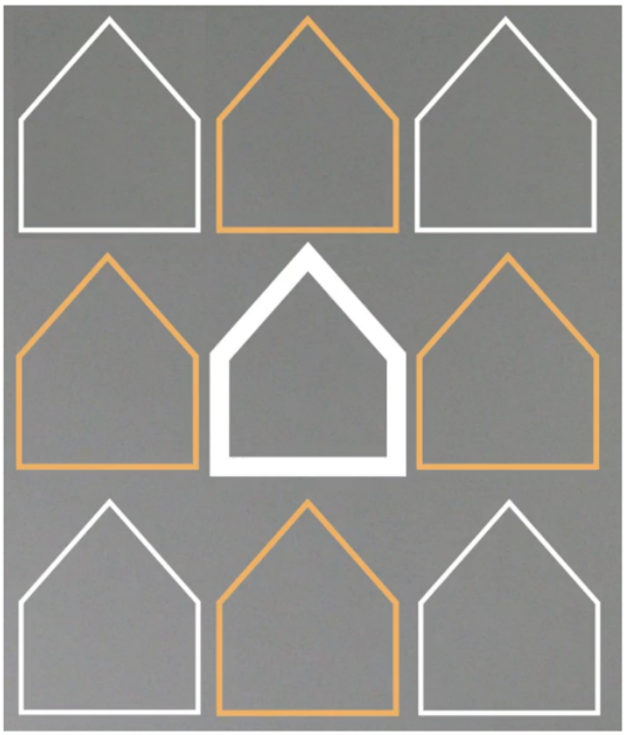
- What are the characteristics of the area and of the individuals?
- What options do they have?
- How do they make their decisions?

How do researchers make such decisions?

In general, which is probably not the most desirable answer, it all depends. We talked about it a bit. Do you remember the crash test dummy? We said that a lot depends on a problem and the process that we want to illustrate

by a certain model. It also depends on the purpose of the model. If we want to have a simple illustration of the basic mechanism, we should have as few elements as possible and as simple as possible. And if we want to make a realistic model, we need to be more specific.

Sometimes we just have to make some technical assumptions. For example, in the case of neighbourhood, we can also imagine that an expert could make a different decision and for example decide that she will treat as neighbours only four nearest houses



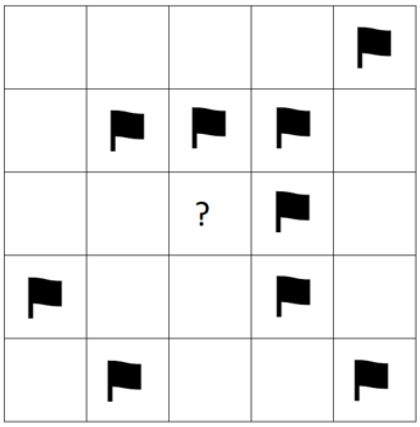
Sometimes we can also make a simple model and develop it by adding more elements. We can also try out different solutions and see what works best.

5. How does the Cherryville protest work? - QUIZ

In this step you will meet several citizens of Cherryville. On the basis of information about their level of threshold and about their neighbourhood please decide if they will decide to join the protest.

QUESTION 1

Jonathan's house is located in a square marked by "?". In every square there is one house. Citizens of houses marked by ⚑ are protesting. His threshold is 60%. Please analyse situations presented in the pictures and say if Jonathan will join the protest today?

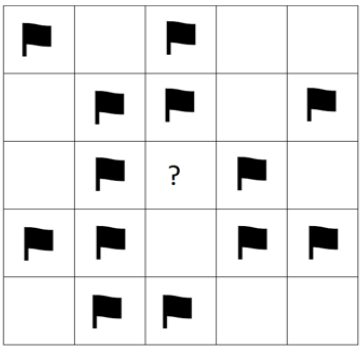


- Yes
- No

QUESTION 2

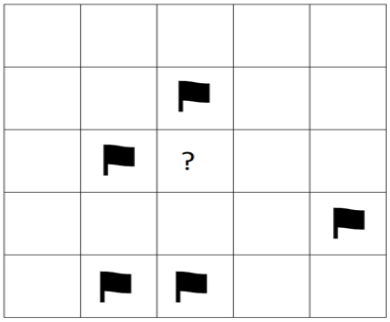
Jonathan's house is located in a square marked by "?". In every square, there is one house. Citizens of houses marked by ⚑ are protesting. His threshold is 60%. Please analyse situations presented in the pictures and say if Jonathan will join the protest today?

- Yes
- No



QUESTION 3

Jonathan's house is located in a square marked by "?". In every square there is one house. Citizens of houses marked by ⚑ are protesting. His threshold is 60%. Please analyse situations presented in the pictures and say if Jonathan will join the protest today?



- Yes
- No

Correct answers

Q1: Yes

Q2: Yes

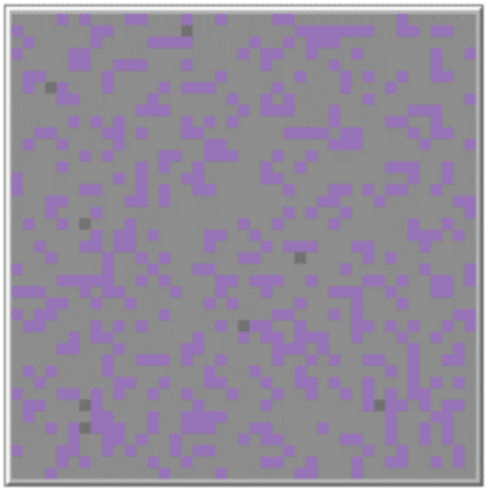
Q3: No

6. Experimenting with Cherryville protests - ARTICLE

© AJ Colores on Unsplash

In the previous steps, you saw how the protest model works. However, Cherryville is generally bigger and we need some kind of a larger scale model. In this article, we will investigate the same model from a bird's eye view, in a similar way that IT specialists would show it to Cherryville authorities. Let's look at how the model would appear and work in 3 different conditions depending on the composition of the town's population.

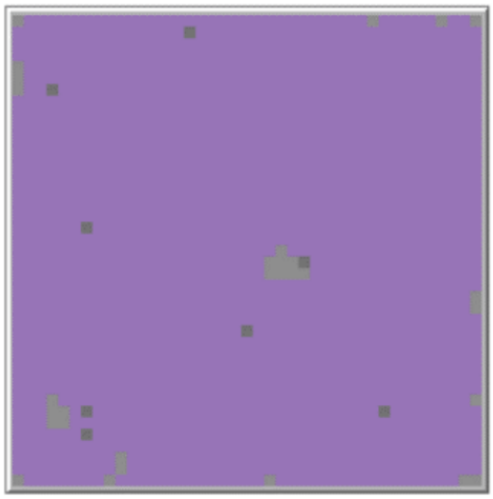
First, let's imagine that in Cherryville people are very socially engaged. They care a lot about their city and its symbols, so they reacted very strongly to the risk of losing the Cherryville Chocolate Dipped Cherries brand. Many people decided to protest by putting transparents in their yards. As they are the first ones to protest (their threshold is equal to 0), they are called the initiators. Those citizens will always protest, no matter what the neighbours around them are doing. Let's see how this town could appear from a bird's eye view.



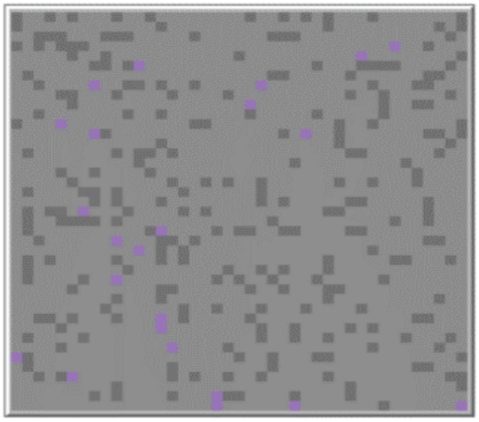
Purple is the colour of the protesters. Grey is for those who are not protesting (yet). There is one more colour in the picture - it's dark grey, which points out the people whose thresholds are above 100 %. This means that they would not join the protest, no matter what.

As it was already said, the people of this town are socially engaged, which means that in general they are rather eager to protest. It does not mean that they are all initiators! However, there are some people who will join the initiators instantly (those with low thresholds or those who are surrounded by the initiators) and some will join later on.

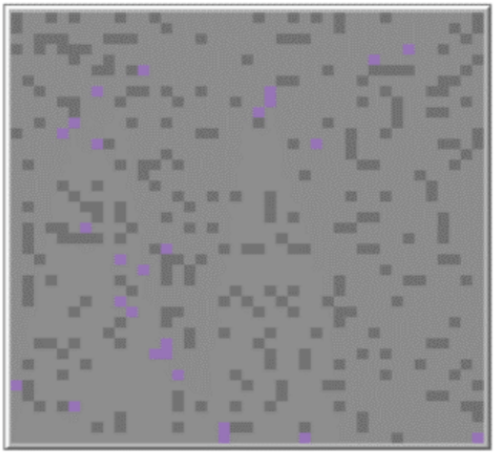
In the end the map might look like this: almost everybody has joined the protest!



Let's look at a different possibility. Here, the community is not that socially engaged. The citizens are not keen on protesting, as most of them are not even aware of the current affairs in city hall. The decision of local authorities to sell Cherryville Chocolate Dipped Cherries brand was met with almost no response. The citizens have, on average, a very high threshold. The Cherryville protest map might look like this in the beginning:

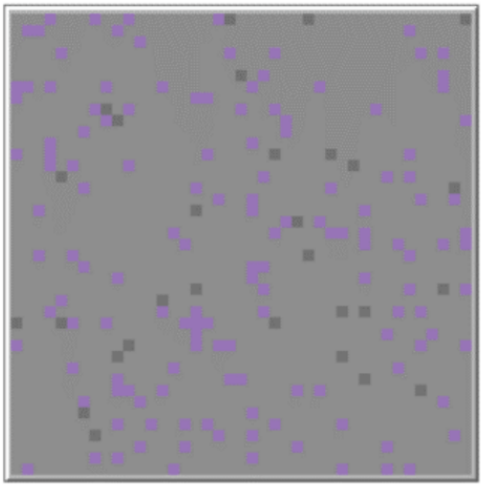


At the end like this:

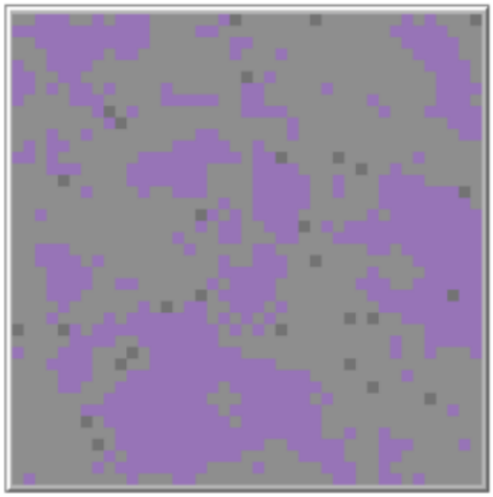


Notice that only a few people have joined!

What could happen if the population of Cherryville was very diverse? Some citizens are very involved in public life, some less, but almost everybody has a basic knowledge of city affairs and is informed about the situation. They may not be happy about it, but they are not furious either. The decision of selling the local brand would be met with objections and the protest starts as there are some initiators there. After that the protest began to spread. This is our starting point.



And this is how the map looks like this at the end (meaning that from then on, nobody else joins the protest. The process stabilises at this point).



What you can see here are some stains of colour, areas where the protest spread and those where it didn't. Those "stains" or "clusters" have different sizes and shapes. What is important is that they are clearly distinguishable from the grey environment around. Is it just what randomly happened in this town or can we expect such a result in other

similar towns and, if so, why? We will get back to these questions later on, after investigating spatial protests in a series of simulations.

And now let's think about another dimension of differences between the three situations described below. Please imagine that you are going for a walk in Cherryville. In the first case you will just see hundreds of flags. In the second one you will probably have to walk for quite a while to see more than one or two flags. In the last one you will either be in a "purple" surrounding or in an indefinitely "grey" surrounding, almost like crossing some invisible lines! From the point of view of Cherryville inhabitants it means that if they are in a purple cluster, they will practically not meet those who won't protest.

Do you recognize this clustering of opinions in areas you live in or live close to?

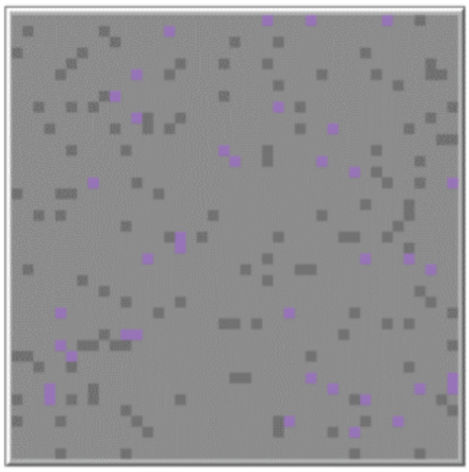
7. Questions about Cherryville experiments - QUIZ

By doing these questions you can check your understanding of the Cherryville experiments.

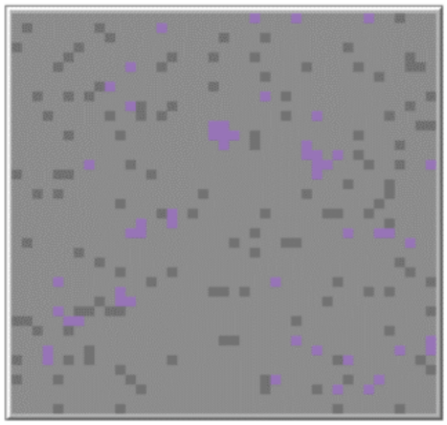
QUESTION 1

Compare the maps of the Cherryville in the beginning and in the end of the protest. How many people joined?

Beginning:



End:

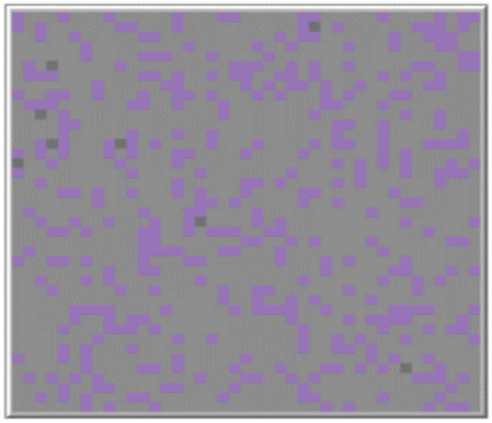


- nothing has changed
- few people joined
- many people joined
- almost everyone joined

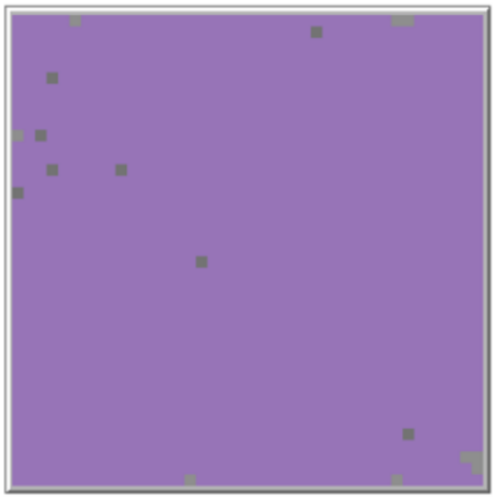
QUESTION 2

Compare the maps of the City in the beginning and in the end of the protest. How many people joined?

Beginning:



End:



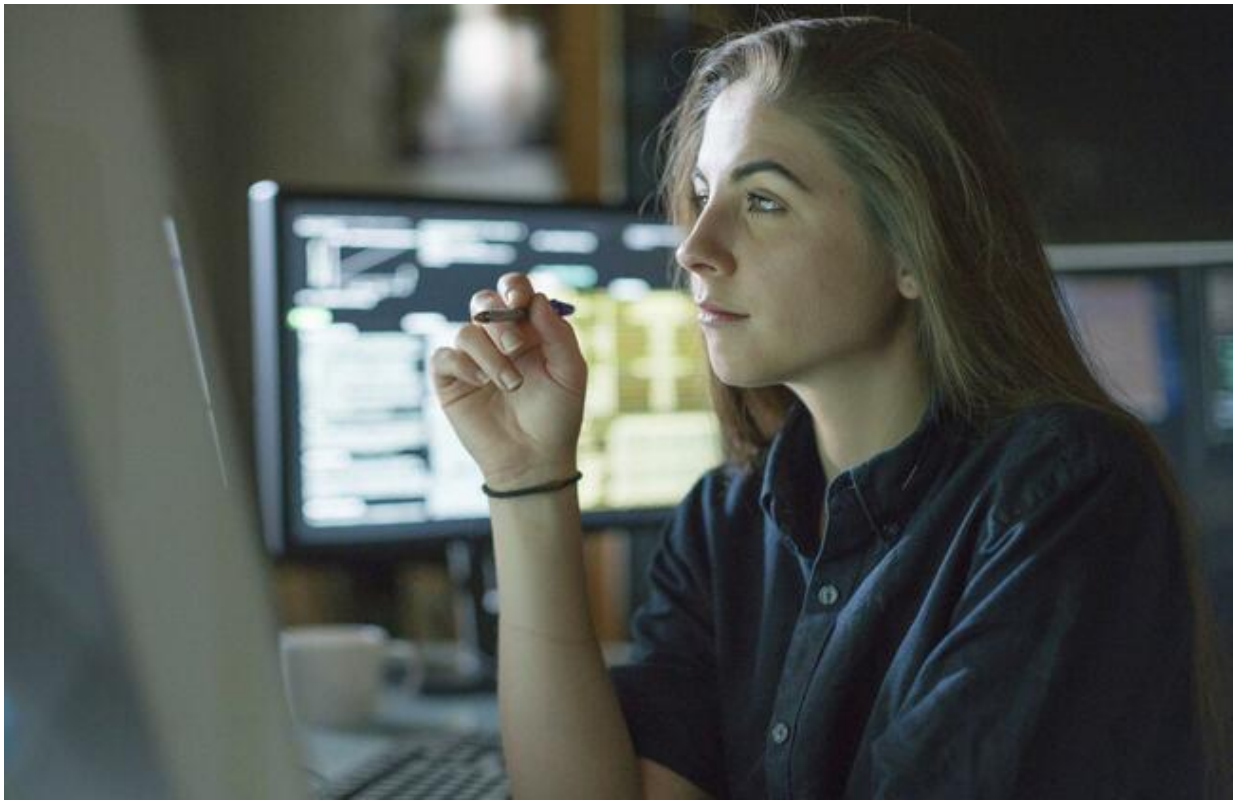
- nothing has changed
- few people joined
- more than half of the people joined
- almost everyone joined

Correct answers:

Q1: few people joined

Q2: almost everyone joined

8. Introduction to NetLogo - ARTICLE



Working with NetLogo © Getty Images

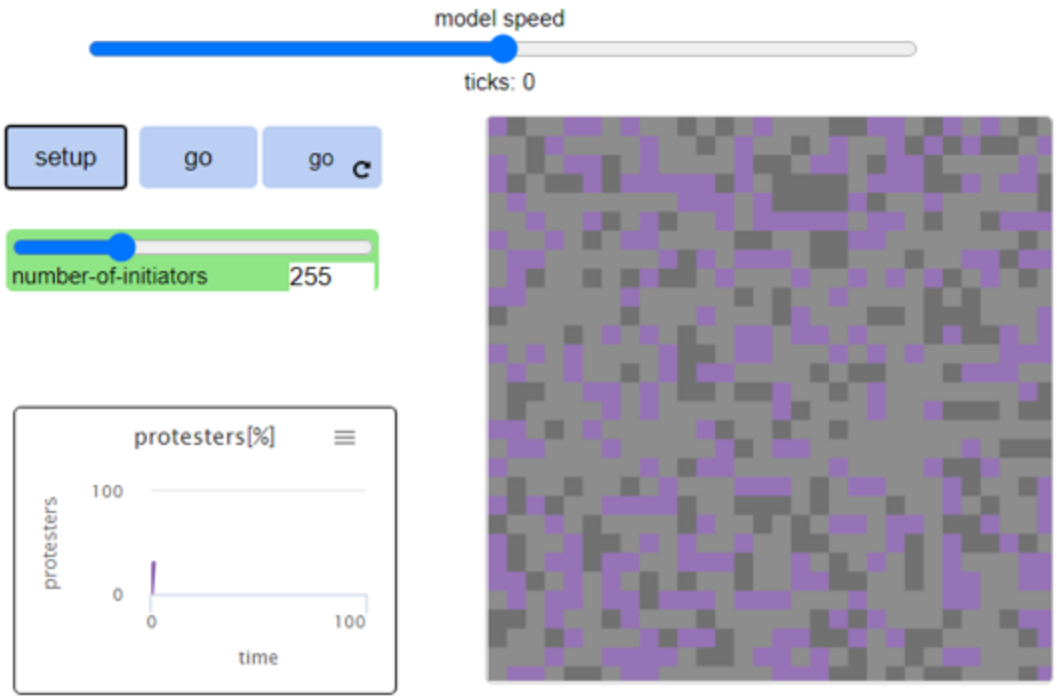
In this step, we will introduce a simple tool that is used for creating and carrying out simulations which is called NetLogo.

You have already seen that even with simple models there are a lot of combinations that might be worth trying out and studying, and for that a computer application might be useful. Here, we will be using such an application and it is worth underlining that for the purposes of this course you do not have to install anything in order to use it.

NetLogo is the name of a quite simple language with which we can build models. It is also the name of a platform where you can find many ready-made models, interact with them and analyse them. If you want to find out more about this language and the platform, you can read it on the NetLogo webpage.

For now, only a few mentions are important and useful.

In the image below you can see how a NetLogo simulation appears. On the right, you can see a town seen from a bird's eye view, just like the ones from the previous steps.



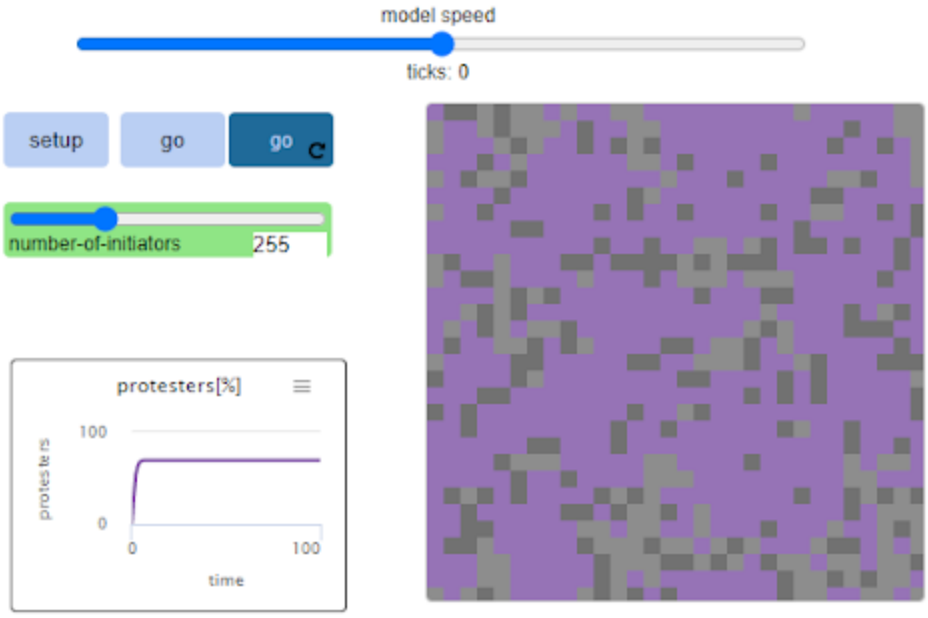
There are some sliders there as well, for example, here you can use a slider to decide how many initiators will live in your city.

If you want to initiate the simulation you need to click on "setup". That way you will get the initial state. Every time you click "setup" you will get a somewhat different initial state because the exact positions of the residents and distribution of initiators are selected randomly. The thresholds of citizens are also randomly selected.

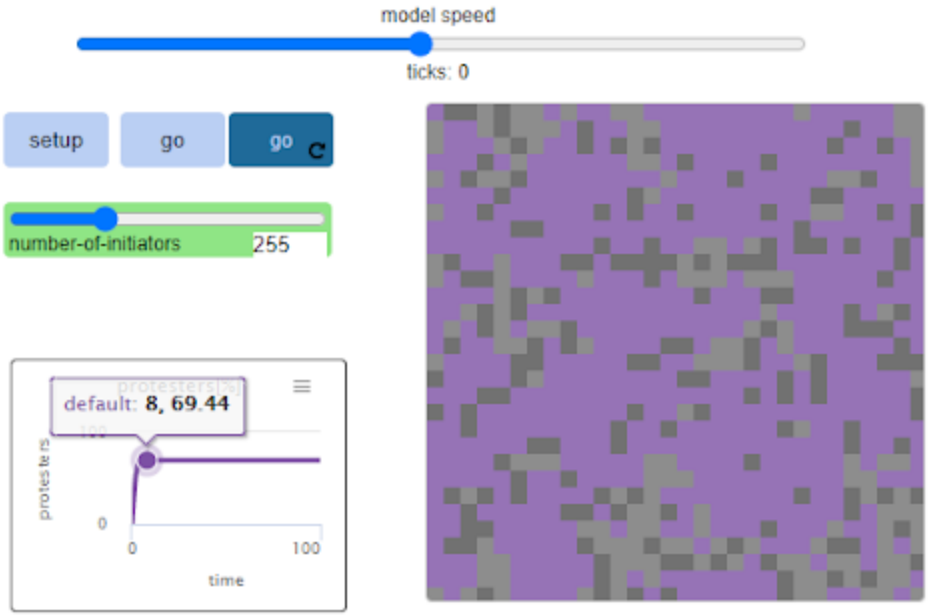
Pressing the "Go" button will start the simulation. Residents will make a single decision to join the protest or not on the basis of their threshold and status of their neighbours. If you press it again and again you will see more decision steps.

As it would be quite tiring to press this button 100 times, instead you should click "Go ↻" then you will see more steps, and the simulation will be "live" until everyone's stops making decisions. How fast it will go depends on the position of the slider "model speed".

Under the picture, you will always see a plot. It will show you how many % of residents are protesting. It will help you observe the dynamics of protest. In the picture, you can see how the model looks after 100 decision steps (in the language of models called iterations). You can see that there are definitely more purple clusters and on the plot you can also observe that at some moment the % of protesters were quickly growing, although after a few steps growth stopped and stabilised to a certain level.



If you want to know the exact number of steps and the percentage (%), you should position the cursor on the plot, the first number is the number of iterations and the second is the percentage (%) of residents who are protesting. In our example, it is the eighth iteration and the percentage is 69%.



So, the general rules are that:

- SETUP gives us our "initial conditions", meaning a starting point.
- GO starts the simulation and takes us one step ahead
- GO ↺ will make our simulation run and unfold until the process stabilises (or until we click it again to make the process stop).
- a slider (here: number-of-initiators) enables us to decide on some characteristics of the situation.
- model speed - sets up how fast the process will unfold
- plot can help track down how the process unfolds and what results we get

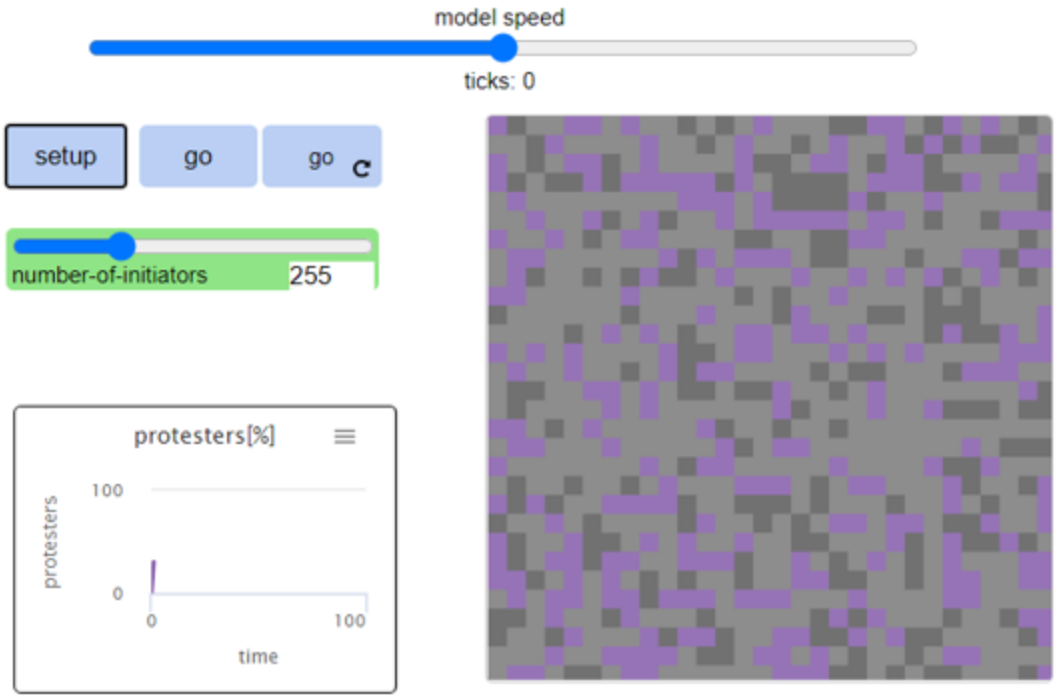
Now it's time for you to try it out in the next steps.

Attention: we highly recommend that the next steps are done on a large screen, either a PC, laptop or a tablet at least, as the models will not be easy to operate on a phone. Furthermore, people who are colour-blind may find these exercises more difficult to do.

9. Simulation of the Cherryville protest - EXERCISE

We prepared a simple model with one slider for you, so that you can try and find out how the protests may grow for yourself.

In this simulation, we can change the number of initiators (the average level of threshold is already set and unchangeable for now, we will come back to that later).



We have 900 citizens in the village and you have the power to change the number of initiators. Initiators are the ones that trigger the other inhabitants to join the protest. See for yourself how the number of initiators changes the spread of a protest.

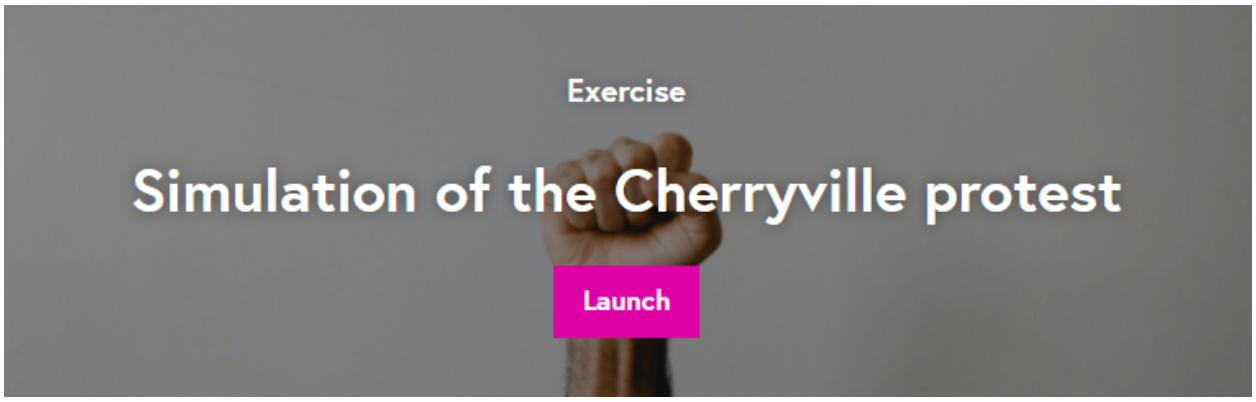
You can set the number of initiators between 0-900. The initiators are marked as purple from the beginning. Other villagers have different thresholds, some are more prone to join the protest and some are less prone - they are marked as grey at the beginning but turn purple when they join the protest.

It is your time to experiment with a model!

Start with a medium number of initiators (for example 400), and see what will change if you lower it or increase it, and then GO!

Feel free to explore it on your own, but we recommend to see what will happen when you set the number of initiators to 400, 250, 100, 10 and then with higher numbers, e.g. 650, 800.

Remember: we highly recommend that this step and the following steps are done on a large screen, either a PC, laptop or a tablet at least, as the models will not be easy to operate on a phone.



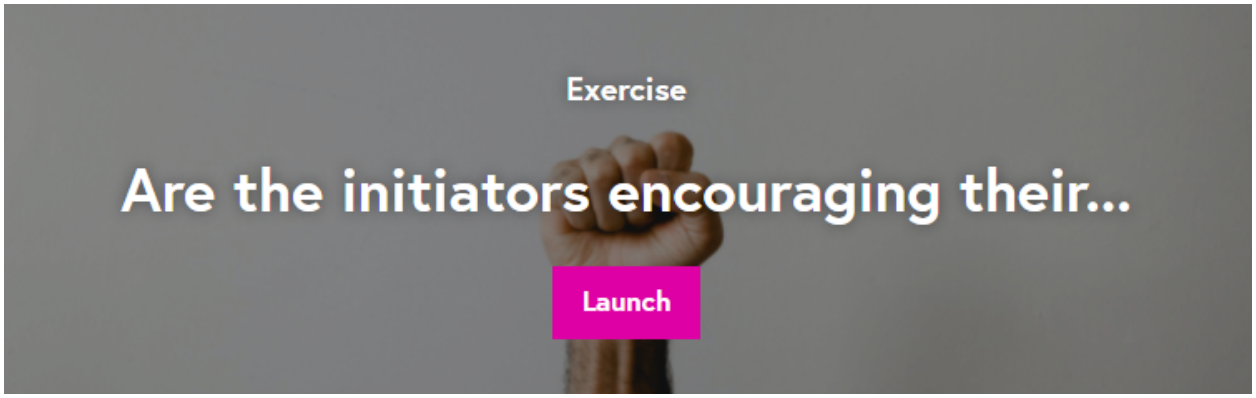
LINK:

https://actiss.github.io/netlogomodels/Models/Introductory/Intro_model3_protest_initiators.html

10. Are the initiators encouraging their neighbours? - EXERCISE

Let's explore the model somewhat further.

Set a very low number of initiators. Use "Go" and look closely at what happens around the initiators. Do they all "start a fire" around them? Do they all encourage their neighbours to join the protest? Please share your findings with other learners.



LINK:

https://actiss.github.io/netlogomodels/Models/Introductory/Intro_model3_protest_initiators.html

11. How do thresholds influence the spread of the protest? - ARTICLE/EXERCISE

When we analyse models we usually play and experiment with them in a systematic way and observe the results. You have actually done it already by moving the slider with a number of protesters. It enables you to decide about one of the possible characteristics of the situation and look at how it influences the final result, in this case the size of the protest and the pattern that we observe. Such a characteristic that we intentionally modify we call a parameter of a simulation.

There can be more than one parameter that you can play with. You will do this in this and the following steps.

Experimenting with another parameter

In our last model we could change the number of initiators. Let's mix it up, and experiment with a different parameter. Now you can change the **average level of thresholds.**

Citizen's threshold as you already know (but just a quick reminder) describes how willing he or she is to join a protest. Thresholds at zero means that a person is an initiator. Low thresholds (close to 0) mean that someone needs a little encouragement to join a protest, it is, in this case, some neighbours who are already protesting. Having a high threshold means that somebody needs more neighbours to join the protest.

Now, let's take it to a city level. Think about the thresholds of all the inhabitants of a certain town. Imagine how hard it would be to choose a threshold for every resident… It could be a huge amount of work.

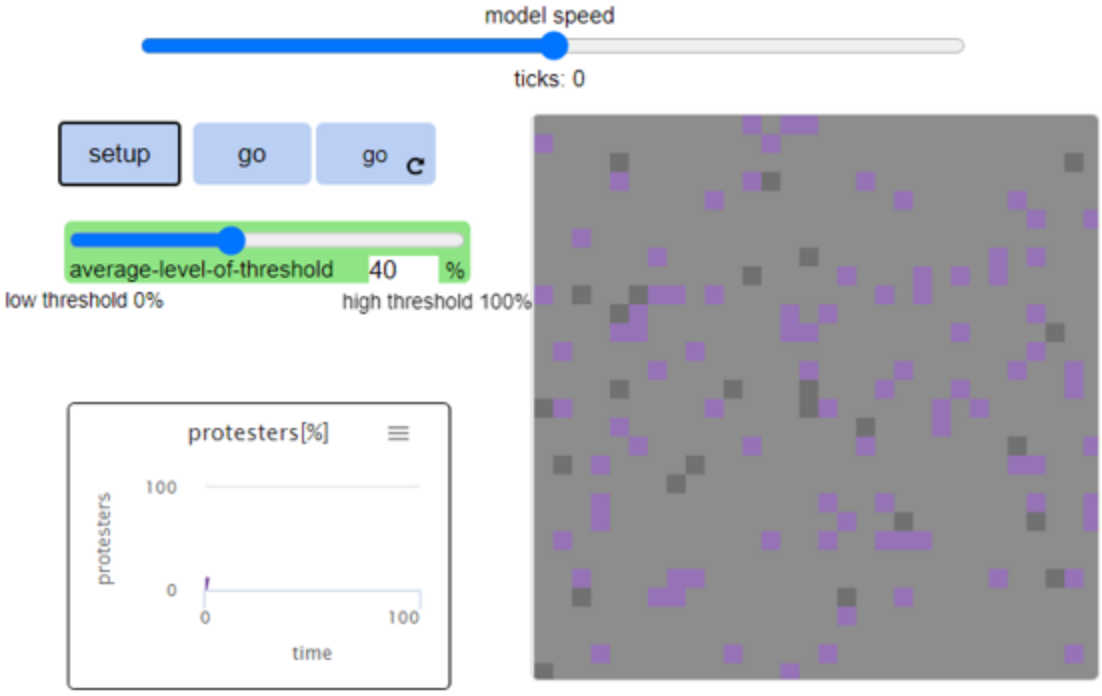
To make it simpler and faster **we use only one slider with an average level of threshold**. Just think about it on a general level, something that describes a whole group, even though this group may be diverse (just like it was with average thresholds in Appleton, Berryville and the other Fruit County villages in Week 1). For example, if the average is 50% it doesn't mean that every resident has to have exactly this level. Some will have a higher threshold and some will have a lower one, but this average describes a general level.

Dutch town, © Storyblocks

So, if we compare a town with an average threshold level of 10% to a second town with an average threshold of 50%, the residents of the second town will be, on average, much less willing to protest.

It is a similar story in models comparing average incomes. We use this parameter in order to compare different countries. For example, in 2019 in Luxembourg the average income was 3,400 EUR and in Poland it was 864 EUR. It does not mean that every resident in these countries earned exactly this amount of money, but it was the most common income and we can say that in general people in Luxembourg earn more than those in Poland.

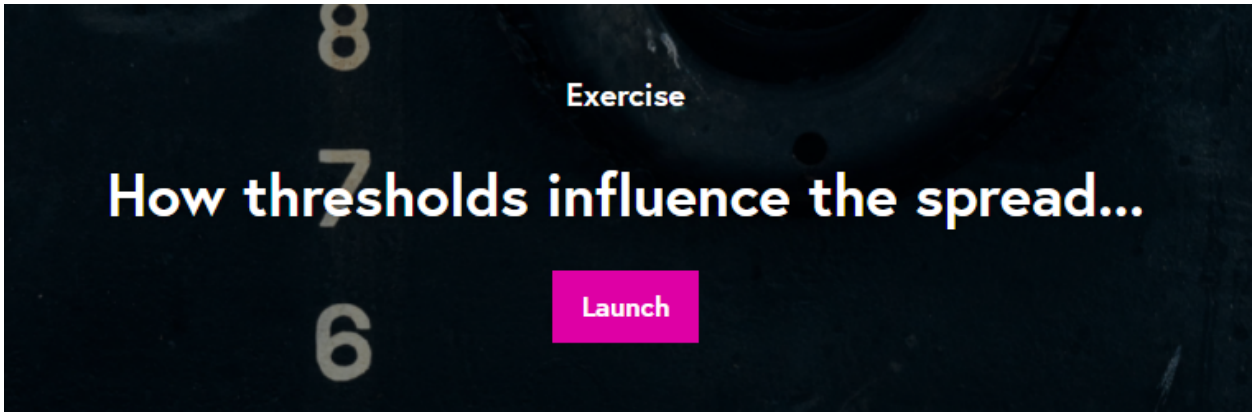
So let's come back to the model of a spatially spread protest. A new model will look almost the same as when we investigated how the process is affected by the number of initiators. The only thing that changes is the slider "average level of thresholds" which replaced the slider "number of initiators**".



You can set the average level of threshold anywhere in the range 0-100%.

While using this model you can monitor the percentage of protesters in the graph, the same way as before.

In the next steps we propose some exercises which will be based on this Netlogo model of protest. You will have an opportunity to explore how changes of the average level of threshold influence the dynamics of growing the protest. What do you think? Please share your thoughts with other learners.



LINK: https://actiss.github.io/netlogomodels/Models/Introductory/Intro_model3_protest_threshold.html

12. Do lower thresholds make protests grow faster? - EXERCISE

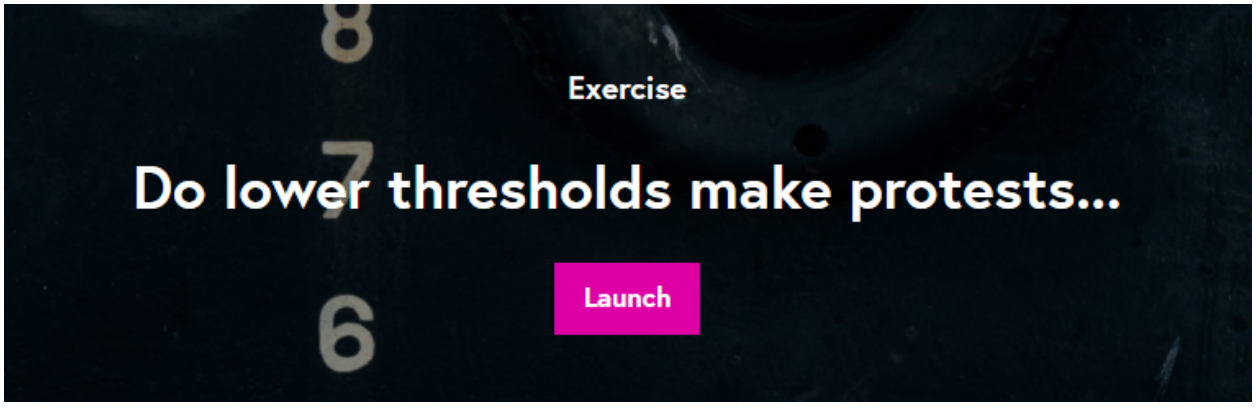
It is your time to experiment with a model! Start with a medium average level of a threshold (ex. 40%), and see what will change if you lower or increase it, and then GO! Feel free to do as you please, but we recommend you observe the effects of thresholds set to 40%, 25%, 10%, 0%, and to 100%, 80%, 65%.

Try to answer some of the following questions.

- How does the average level of threshold change the patterns that we get in the end?
- Under what circumstances can we expect the biggest attendance? When will it be the smallest?
- Which average level of threshold is the best for an evil governor, who wants to change funding and doesn't want people to protest?
- Which is the best for activists who would like to start a new movement?

And now try out one specific combination and observe the process a couple of times. Try out setting the average threshold at 45%. Try it out several times. Observe how the final protest size changes. Sometimes we end up at 20% and sometimes it's closer to 35%. It's not always exactly the same although we have the same number of initiators and the same average level. Spatial arrangements, such as where the initiators are, also matter. Remember how we had a similar observation in the case of the Fruit County protests?'

How did the experiments with threshold levels go? What did you observe? Please share your experiences with other learners.

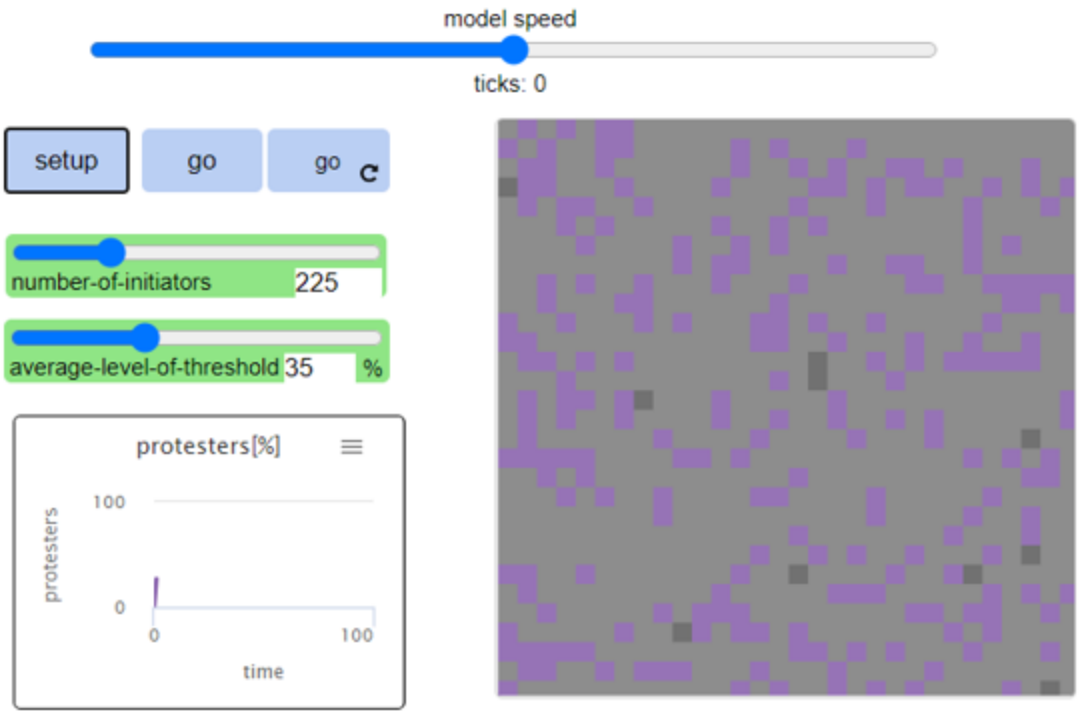


LINK: https://actiss.github.io/netlogomodels/Models/Introductory/Intro_model3_protest_threshold.html

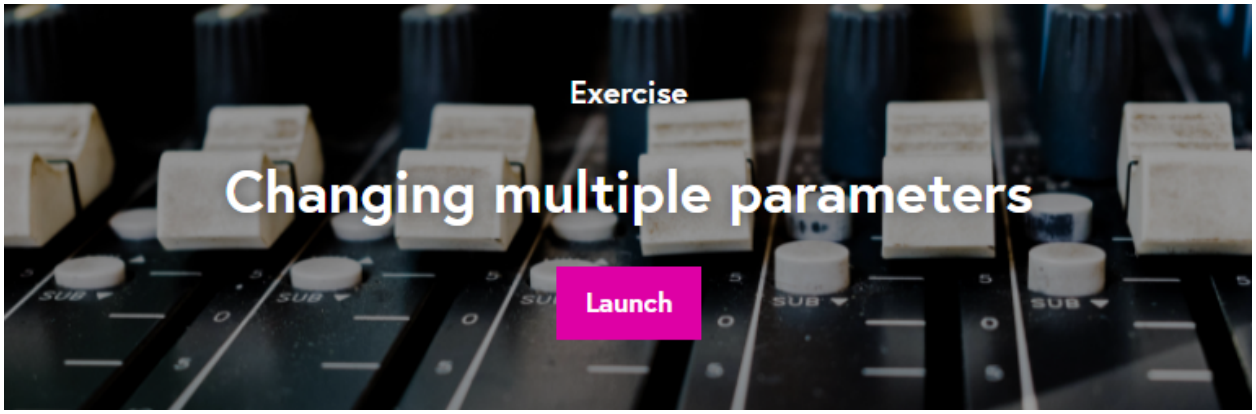
13. Changing multiple parameters - ARTICLE/EXERCISE

You already know what will happen when you change the number of initiators and the average level of thresholds separately. Our next model allows us to investigate a combination of those two issues and change both the number of initiators and average level of thresholds.

Here, when the average level of thresholds is set it relates to the group that was not randomly chosen to be initiators. For example, if you set a high number of initiators (e.g. 400) and a very high level of average thresholds (e.g. 90%), this means that the community will consist of a large group of initiators (those that were randomly chosen, namely 400 people) and all other people will be very reluctant to join the protest.



Start your own exploration with the number of initiators = 225 and the average level of threshold = 35%. What do you think might happen? See if you were right! Try to change only one parameter at a time and see how it affects the situation.



LINK:https://actiss.github.io/netlogomodels/Models/Introductory/Intro_model3_protest_initiators_threshold.html

14. Simulation exercises - QUIZ

In this exercise try out different combinations in a model. Try to think about the initial conditions and observe what happens. For each combination, it's good to try a few times and see if the results are similar.

QUESTION 1

Use the model and try out setting the number of initiators = 300 and the average level of thresholds = 55% What can we observe here? What kind of patterns?

- Almost everybody (more than 90% of citizens) takes part in the protest.
- Many people take part in the protest, big clusters emerge.
- Only a few people take part in the protest (less than half), small clusters emerge.
- No one is protesting.

QUESTION 2

Use the model and try out setting the number of initiators = 300 and the average level of thresholds = 55% .

- This community is not socially engaged at all, no one wants to protest.
- Citizens are not really into protesting, but few of them are eager to protest.
- This community is very divided, there is a group that is very socially engaged but the others are very reluctant or would never go to a protest.
- People living in this city are socially engaged, a lot of people are eager to protest.

QUESTION 3

Use the model and try out setting the number of initiators = 0 and the average level of threshold = 10%. What can we observe here? What kind of patterns?

- Almost everybody (more than 90% of citizens) takes part in the protest.
- Many people take part in the protest, big clusters emerge.

- Only a few people take part in the protest (less than half), small clusters emerge.
- No one is protesting.

QUESTION 4

Use the model and try out setting the number of initiators = 0 and the average level of threshold = 10% What can we say about this community? What is the starting point?

- This community is not socially engaged at all, no one wants to protest.
- Citizens are not really into protesting, but few of them are eager to protest.
- This community is very divided, there is a group that is very socially engaged but the others are very reluctant or would never go to a protest.
- People living in this city are very socially engaged. A lot of people are eager to protest.

QUESTION 5

Use the model and try out setting the number of initiators = 5 and the average level of threshold = 10% What can we observe here? What kind of patterns?

- Almost everybody (more than 90% of citizens) takes part in the protest.
- Many people take part in the protest, big clusters emerge.
- Only a few people take part in the protest (less than half), small clusters emerge.
- No one is protesting.

QUESTION 6

Use the model and try out setting the number of initiators = 5 and the average level of threshold = 10% What can we say about this community? What is the starting point?

- This community is not socially engaged at all, no one wants to protest.
- Citizens are not really into protesting, but few of them are eager to protest
- This community is very divided, there is a group that is very socially engaged but the others are very reluctant or would never go to a protest.
- People living in this city are very socially engaged, a lot of people are eager to protest.

QUESTION 7

Use the model and try out setting the number of initiators = 100 and the average level of threshold = 80% What can we observe here? What kind of patterns?

- Almost everybody (more than 90% of citizens) takes part in the protest
- Many people take part in the protest, big clusters emerge.
- Only a few people take part in the protest (less than half), small clusters emerge.
- No one is protesting apart from the initiators.

QUESTION 8

Use the model and try out setting the number of initiators = 100 and the average level of threshold = 80% What can we say about this community?

- This community is not socially engaged at all, no one wants to protest.
- Citizens are moderately eager to protest.
- This community is very divided, there is a group that is very socially engaged but the others are very reluctant or would never go to a protest.
- People living in this city are very socially engaged, a lot of people are eager to protest

Correct answers:

Q1: Many people take part in the protest, big clusters emerge.

Q2: People living in this city are socially engaged, a lot of people are eager to protest.

Q3: No one is protesting.

Q4: People living in this city are very socially engaged. A lot of people are eager to protest.

Q5: Almost everybody (more than 90% of citizens) takes part in the protest.

Q6: People living in this city are very socially engaged, a lot of people are eager to protest.

Q7: No one is protesting apart from the initiators.

Q8:This community is very divided, there is a group that is very socially engaged but the others are very reluctant or would never go to a protest.

15. Initiators and protests - DISCUSSION

Taking into account all the experiments with the simulation, let's briefly pause and reflect on what you have learned.

What do you think is a better environment for organising a protest:

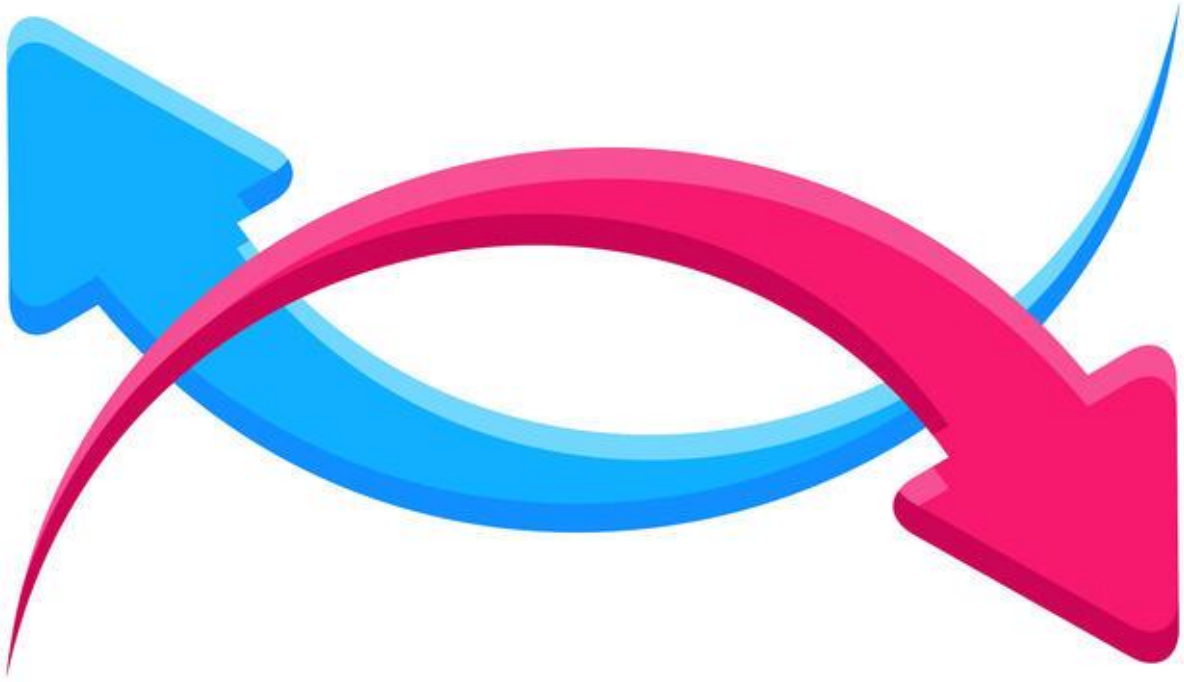
- a population where there are a lot of initiators, but all other people are really reluctant to join the protest

  OR

- a population where there are a few initiators, but people, in general, are quite willing to go to a protest?

Please share what you think and why with other learners.

16. Protests that spread spatially - ARTICLE



© Storyblocks

In this article, we will investigate how protests spread spatially and take a closer look at the cluster of colours that we observed during the experiments.

First, we will describe the whole process that led us from Cherryville to a NetLogo simulation. In the series of various exercises, we investigated how protests may spread spatially. We assumed that people have different attitudes towards protesting (diverse thresholds) and when deciding on whether to hang a banner in their windows they observe their surroundings and on the basis of those observations they decide whether to join a protest or not. This was the process of modelling.

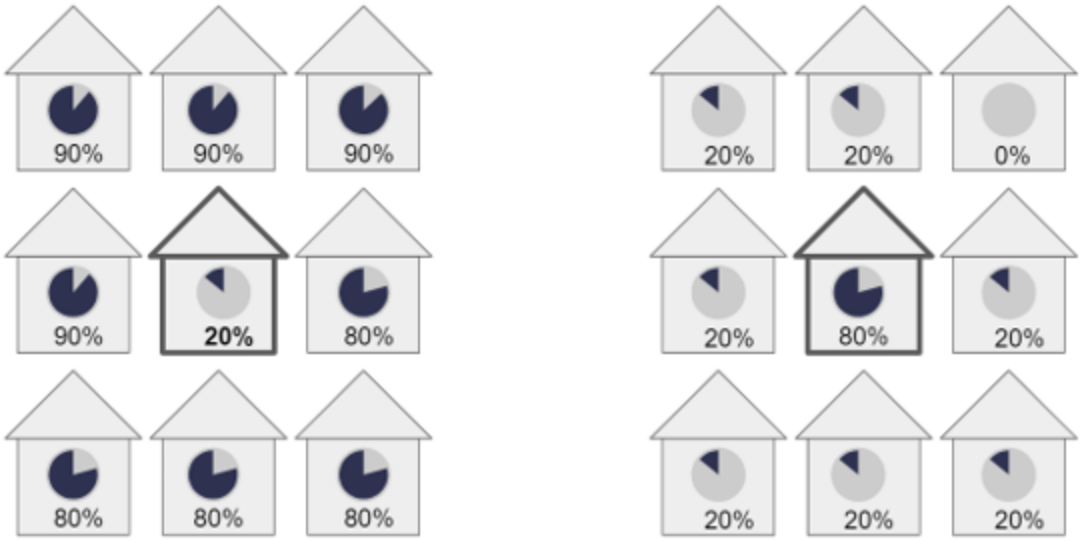
Then, we investigated Cherryville and some other cities, first in a close-up (pen-and-paper model) and then we took it to a more general level using a digital tool to simulate the process. With the use of simulation we studied how the process would unfold in a number of potential cities, or, we should rather say, for a number of different combinations of initial conditions.

So what can we learn from those simulations?

In general, the higher the number of the initiators and the lower the general level of thresholds, the bigger the protest. However, just as in the case of other complex processes, it's not so simple. So, let's sum up the not-so-obvious insights that we receive from investigating the model.

Neighbourhood matters

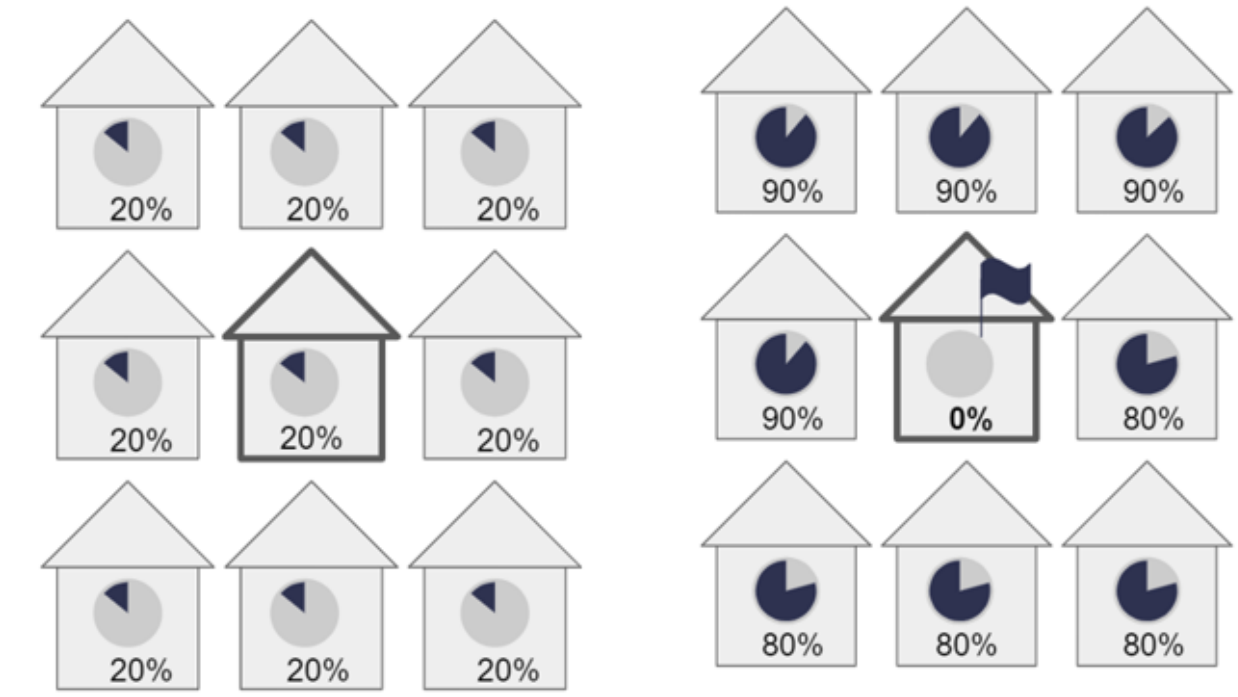
Two people with the same threshold (the same attitude towards the protest) may or may not take part in the protest, depending on who they are surrounded with. It's similar to the way friends' behaviours influenced the final decision of potential protesters in the networked version of the process. In the same city we may have Samantha who is very eager to protest (threshold=20%) not joining in and a very reluctant Terry (threshold=80%) hanging the banner, because their neighbourhoods are different.



- Samantha (20%, surrounded by people who are more reluctant)
- Terry (80%, reluctant himself, surrounded by people more prone to protest)

Initiators play a key role but their impact depends on their surroundings

Even if we have an average threshold of 20% which is low, it won't help spread the protest if there are no initiators to "start the fire" (image) . On the other hand, an initiator surrounded by very reluctant neighbours will remain to be a lonely spot within a grey area. So, in order for the protest to occur both the initiators would be there and some early-goers nearby.

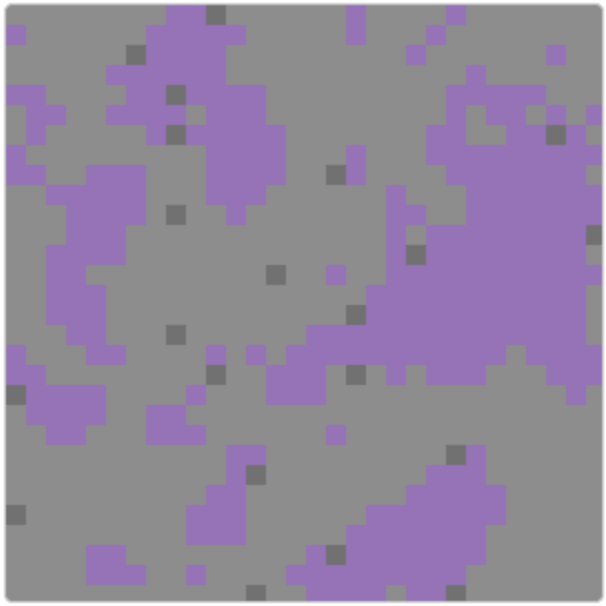


- The neighbourhood on the left has inhabitants with low thresholds, but no initiator, so the protest does not start.
- The neighbourhood on the right does have an initiator, but the protest never spreads as his/her neighbours are reluctant to protest

- In this neighbourhood, there is an initiator surrounded by at least some eager neighbours, so the protest will start and spread.

Typical patterns - no protest, everyone protesting OR clusters of protesters

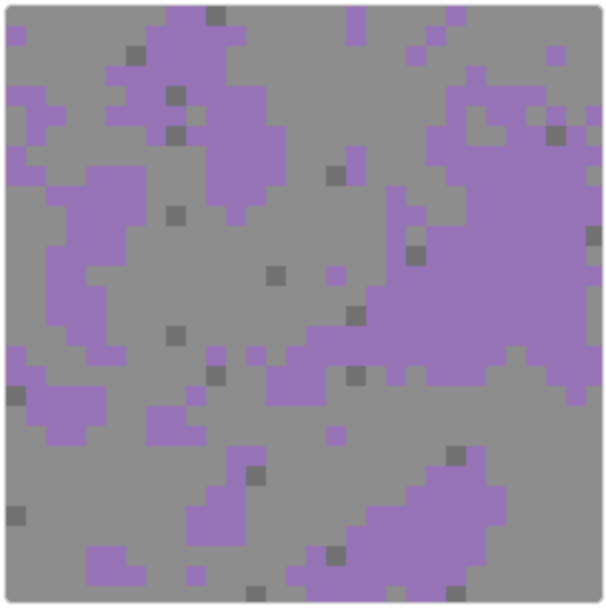
With every different combination of parameters (number of initiators, average level of thresholds) we usually obtain one of the listed patterns, either no one is protesting, the protest spreads in the whole population, or and this is the one we will focus on, we get visible clusters of colour.



The results often look almost as if they were painted. There are places in the city where the flags are all around and there are places with no flags at all (please imagine walking through the city). We could think that there are active neighbourhoods (people are so active there, very low threshold) and passive neighbourhoods (very high thresholds) but this is not true! This would be placing the blame on the people not on the process and situational factors. Let's just look at one example.

In the image you can see that the protest has spread on the right side of the village. On the left side, there are also people who are eager to join the protest (low thresholds) but a group of quite reluctant citizens in the middle stop

the spread of the protest. Six houses on the left actually have a lower average threshold than the six houses on the right - but because of the group in the middle the area on the left will stay “grey” and we won’t see any flags there.



So, a map like the one above can appear in a city where thresholds are pretty random and quite evenly distributed. It does not mean that in the middle everyone is happy with the new highway plans (or any other unpopular decision). Maybe there were no initiators there? And some more reluctant citizens on the boundaries of this area just stopped the spread that came from the “purple areas”. And the “island” of protesters in the upper part of the map does not mean that they are all very unhappy or angry - this might be just an island built around three initiators that happen to live there.

It is important to have those images in mind when we try to explain why certain processes succeed in certain areas and fail in the others. Instead of blaming the people and thinking they are merely either passive or active (or good, or bad) it’s worth taking the time to dig deeper and think about the presence and the placement of initiators, about their surroundings, and investigate if there are any places where the spread is blocked (not intentionally).

One more remark to reflect upon: in all the experiments we used the example of a protest. But just as in the case of our first simple example with Appleton and Berryville, we can think about how this model of a social process is more universal. Instead of thinking about hanging the banners, we can think of a way a garden fashion spreads. Or an innovative method used in farming. Or segregating trash.

Can you think about other processes that might spread spatially? Please share your ideas with other learners.

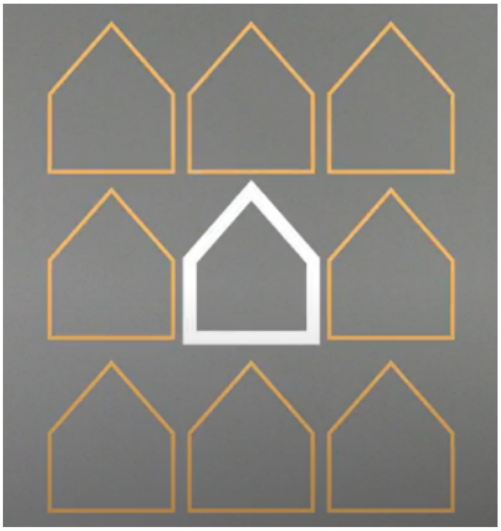
17. Agent-based models - ARTICLE + VIDEO

Agents © Randy Fath on Unsplash

In this step we would like to say something more about the type of models you were exploring this week. Those models are quite simple examples of a wider group called agent-based models, or ABMs for short.

Those models are based on individuals, called agents. Who are those agents? In our simulations agents were inhabitants of all Fruit County villages you were experimenting with. However, **in a wider sense those agents might be both individuals and people, animals, or collective entities, such as organizations or groups.** They interact with each other, they decide what to do on the basis of what is happening with other agents (for example neighbours in our simulation, or friends in the Grapevine example) and may have different strategies.

Bear in mind that there are a **set of rules that lead to the agents' behaviour.** In case of spatial models the agents are spatially distributed in some specific and defined environment. In our case this environment looked a bit like a big chessboard, but this is just one example and it might look different.



Agent-based models can be useful for analysing and illustrating various phenomena. They can be used for simulation of biological processes, interactions between animals, urban planning, epidemiology, consumer behaviour, crowd behaviour, social influence (how we influence other people with our opinions), migration processes and many, many others.

For social scientists this approach is especially fruitful due to the fact that we're focussing on the agents and their behaviour, which is a really natural way of thinking for social scientists. Then, by setting the rules, environment and relations between the agents we can study and better understand social processes. In addition, we can visualise it all in such a way that some insights are plainly visible.

With all that in mind, please watch a short interview with Joshua Epstein, one of the most prominent specialists in the field of social simulation (and author of Generative Social Science: Studies in Agent-Based Computational Modeling), speaking about different applications of agent-based models:

Click on video to view the trailer

This is an additional video, hosted on YouTube

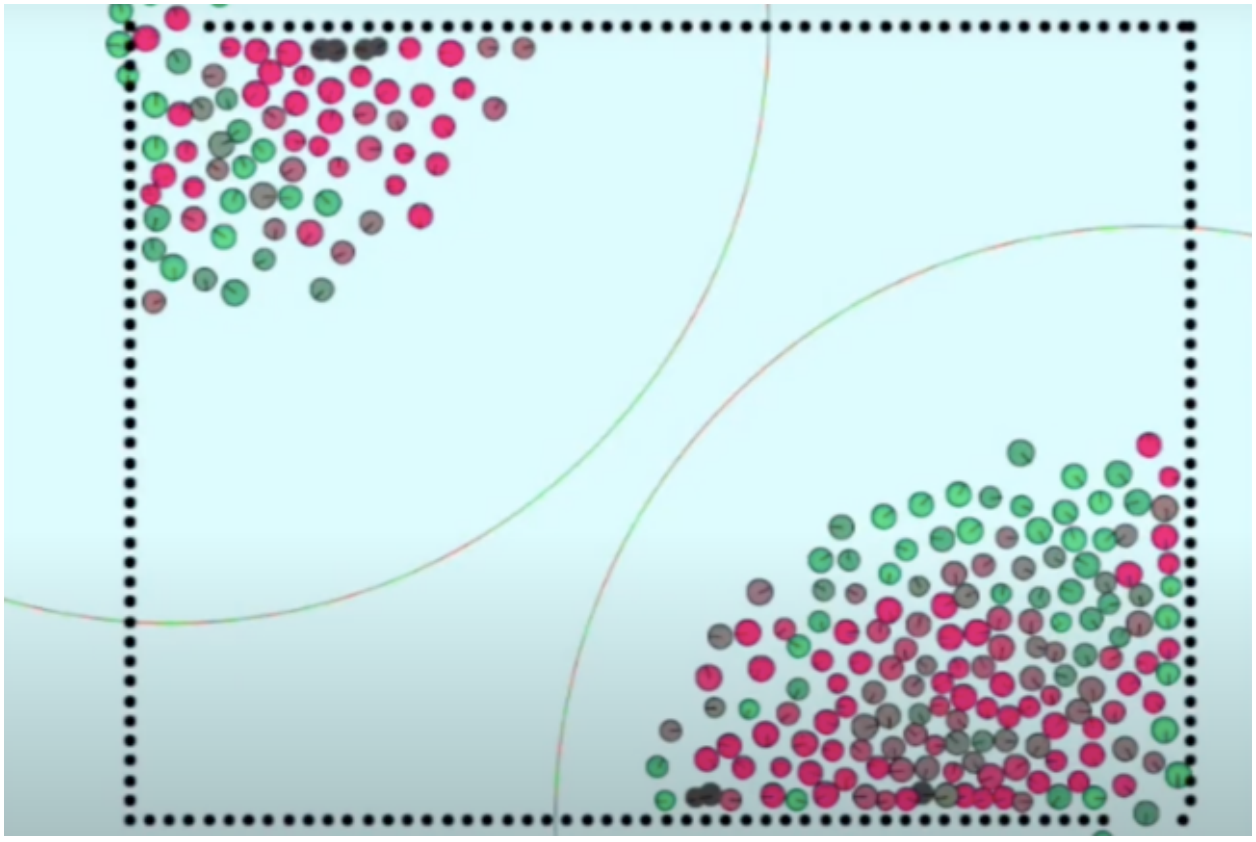
One note: this interview was made before the pandemic started, so the beginning of the interview may sound a bit disturbing.

Additional watching:

For those of you who want to know a bit more about agent-based models we recommend watching this video (you can also use it as a podcast).

Click on video to view the trailer

18. Agent-based models in practice - ARTICLE + VIDEO



As we said there are a lot of examples of applications of agent-based models. Some models are used to understand a basic mechanism of social behaviour, others are used to predict social behaviour and sometimes also to help design social policies that prevent or solve problems.

Below, you can find two videos that show different applications of agent-based models.

In the first one, you will see how a model is created and how scientists gather data that can help shape the model:

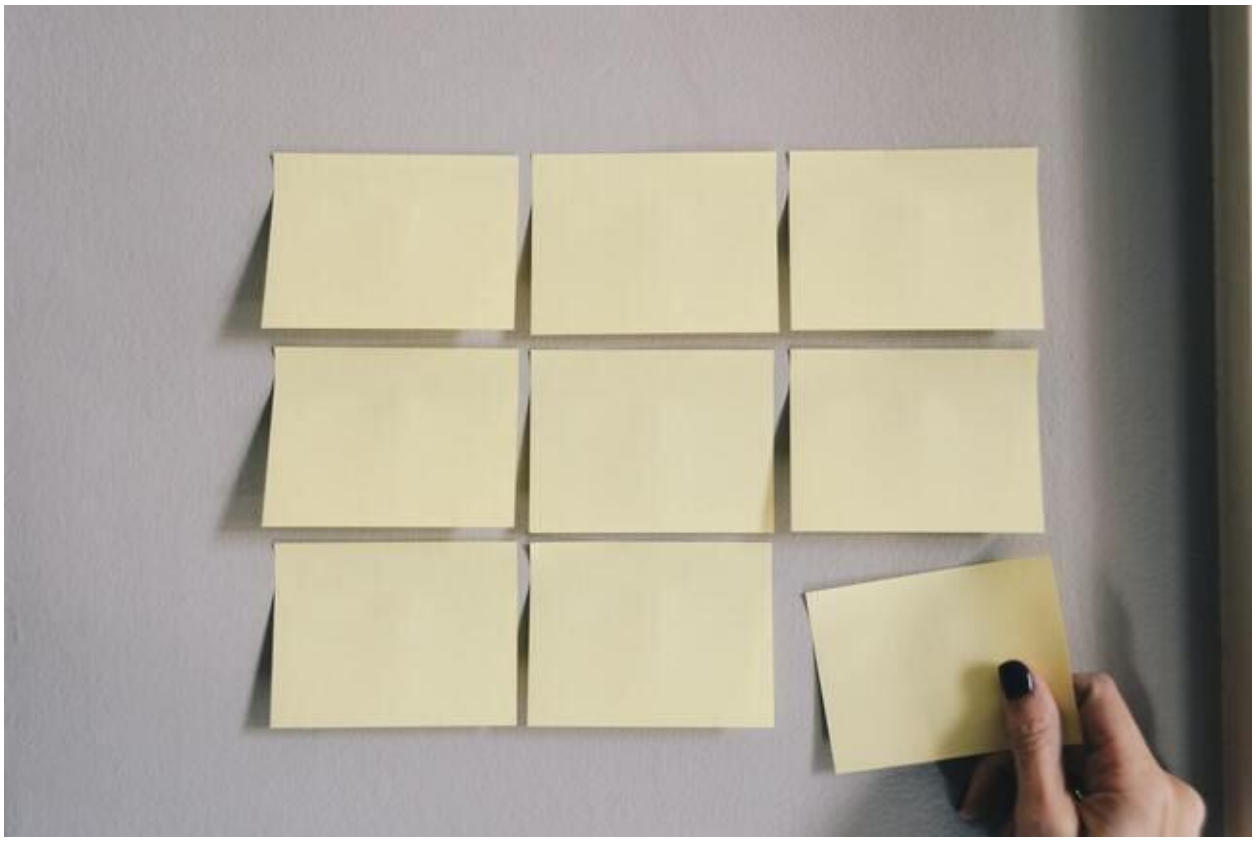
Click on video to view the trailer
This is an additional video, hosted on YouTube.

In the second one you can see how agent-based models can help design the strategies of evacuation:

Click on video to view the trailer
This is an additional video, hosted on YouTube.

Who are the agents in these simulations? In what ways are those simulations similar to the Cherryville protest and in what ways are they different?

19. Formulating a model wishlist - DISCUSSION



Post it's on a wall © Kelly Sikkema via Unsplash

You've seen some applications of agent-based models, and you've started the course with some questions about social processes in mind.

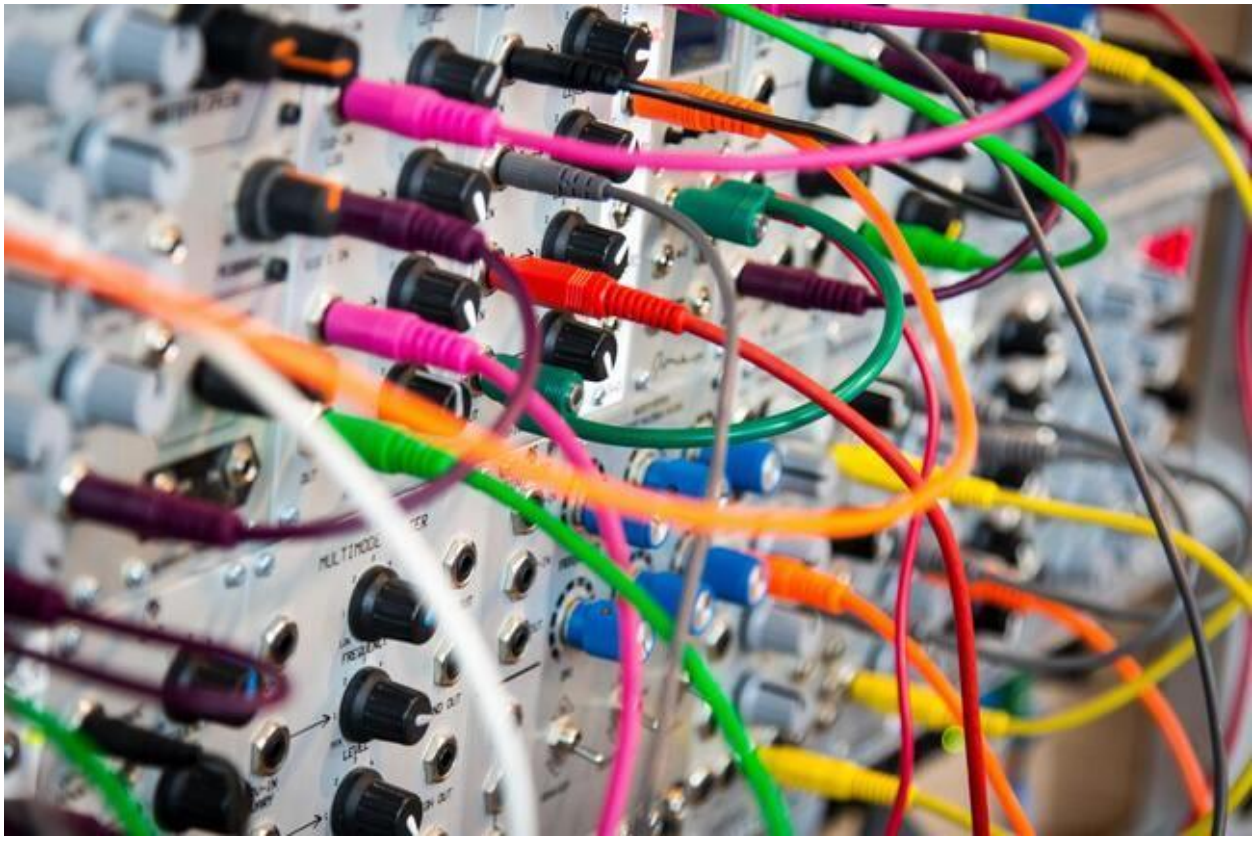
Now, can you think of any social process that you'd most like to see a model of? If you could play with simulations of one social process, whether work-related or related to social life or global problems, what would that simulation be about?

20. Can modelling and simulation help in making decisions? - VIDEO

Click on video to view the trailer

In this interview Wander Jager, Director of the Groningen Center for Social Complexity Studies, explains how modelling and simulations can help in making decisions.

21. Complex social processes and computational models - ARTICLE



Complexity © John Barkiple on Unsplash

We started the course with one main observation - that social processes are quite hard to predict. Sometimes changes happen where we wouldn't expect them to, or with a surprising speed or scale. In other cases there is no change even though we would like it to happen, like in the case of some ecology-related choices.

In the course all the stories, examples and exercises should help you:

- experience that social processes are complex and there is more to them than meets the eye;
- explore how computational models can help us deal with these complications.

Social processes are complicated

So, let's start with the first one. In fact, social processes are quite complicated to predict, for a number of reasons:

- large number of people are involved
- people are complicated themselves and differ from each other
- people interact with each other and influence one another
- and it all changes in time

When you start thinking about social processes in a way that embraces all these statements and puts them into focus of attention, it means that you're studying social dynamics.

Social dynamics is a study of social processes that links micro-behaviours with the final result on a social level. In order to understand such processes, we have to dig deeper and instead of thinking about a mass of people, we need to think about the mechanism behind the process. So, the first major point from all the examples and stories within the course is that social processes are complicated and it's not only the people that count but also what happens between them.

There are some **major points from deciphering social processes** that relate not only to our protest-organisation example, but also to social processes in general:

- it's not only characteristics of individuals that count (e.g. average threshold level), but also some specific features of the group (e.g. the size of the early goers group) and structure (e.g. shape of a network, spatial arrangements of a neighbourhood);
- social processes are rarely linear, we can expect "jumps" and flat lines and all different shapes of the lines;
- sometimes a small change can lead to a huge change in the final result (Butterfly Effect);
- sometimes an orderly pattern appears because of uncoordinated actions of individuals (it emerges).

Computational models

Because of this complicated nature of social phenomena, we need a tool that helps us decipher them and **this is where computational models come in handy**. As Joshua Epstein, one of the most famous experts within the field, said:

> *Grow it and you'll know it.*

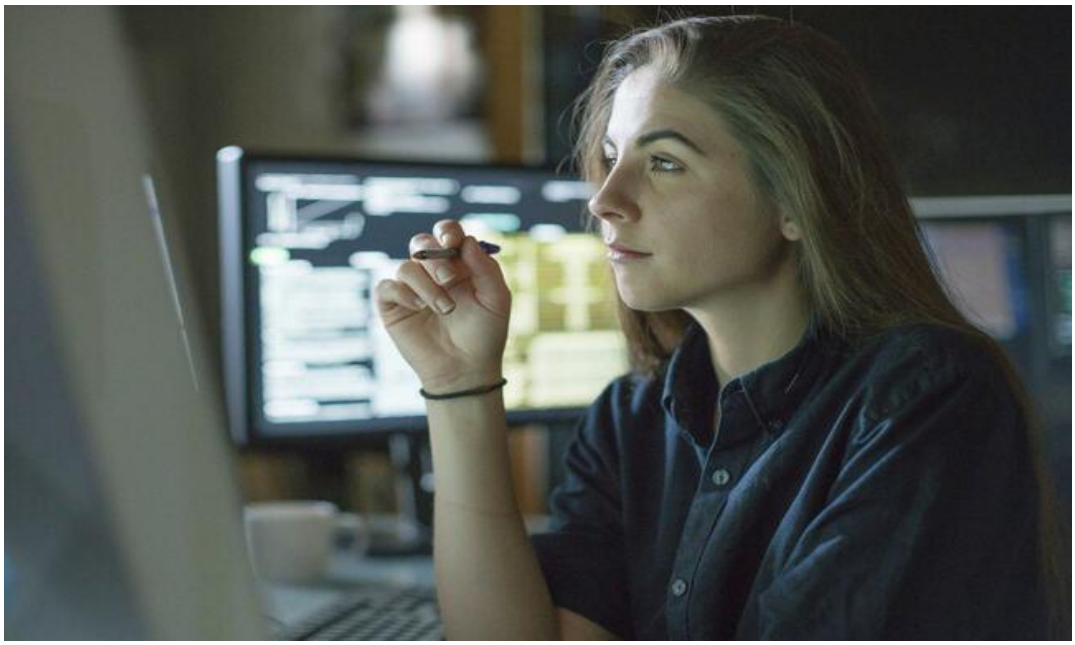
When we are modelling, we need to make precise choices and pick the most important elements of a certain process and then figure out how they work together. By trying out different examples (whether pen-and-paper or with the help of a digital tool) we can simulate how the process would unfold. Simulations can help us **uncover the basic properties of a process** and give us insights about what we need to pay attention to. For example, in case of the protest-story, they helped us see the importance of initiators and early-goers groups, the role of blocking clusters in the network and that we can expect big clusters in a city just like it were segregated - even though it wasn't.

There is one more feature of computational models worth mentioning. Modelling requires precise language and forces people to translate some of their observations about humans or about their environment to **a set of simple numbers and rules**. This is extremely helpful when we want to deal with some multidisciplinary challenges and we need experts from different fields to work together. For example, when dealing with energy transitions we'd probably

need some engineers and sociologists, psychologists, and economists in order to fully understand how we can change energy use in a certain area. While creating a model, all those experts have to translate their concepts into one language.

Models and simulations can have different purposes and be less or more detailed. On the one end of the scale there are very simple ones that illuminate the main mechanism of a process (just like a simple threshold model from Week 1). On the other side of the spectrum, they can be very specific and sophisticated and help analyse a specific process in a specific environment (e.g. evacuation strategies for a certain area or traffic models for a city). Within the broad world of Computational Social Sciences a whole range of different strategies and applications of models and simulations can be found and we encourage you to explore it further. This approach is really helpful in tackling the difficult consequences of our fascinating social nature.

22. What next! ARTICLE



People Networks and Neighbours © Getty Images

You have come to the end of the course. Well done!

Let's revisit what you have learned. Within the course:

- you explored why social processes are complicated and why it is hard to predict them
- you put the stress on the way micro-behaviours lead to - often unexpected - results on a social level
- you experienced how we can analyse social processes using models and simulations

- at the same time you experienced how computational approach to study social behaviour works
- you investigated a case study of a process of how a protest grows (or not) and what factors may be important to that process. You started with a simple threshold model and then worked with more advanced models: a networked model (Week 2) and a spatial model (Week 3)
- you used a simulation in order to investigate a model of a protest that spreads spatially

This course is a part of an educational initiative Action for Computational Thinking in Social Sciences. This project is carried out by a strategic partnership formed by enthusiasts of modelling and simulations and opening-up education and included partners from Warsaw, Groningen and Berlin. It was co-funded by Erasmus+.

If you are interested in exploring Computational Social Sciences further (and we sincerely hope you do), we encourage you to:

- visit the project website and learn more about the initiative;
- try out our other courses, including Social Network Analysis and an upcoming course on game theory and socio-ecological models, titled Are we doomed to destroy our planet?
- explore the approach further with the use of some handbooks on the Further reading list provided below.

If you are a student, we also encourage you to look for Computational Social Sciences courses, both within your educational institution and online (try looking for topics such as: computational models, computational social science, modelling and simulations, agent-based models or social network analysis).

If you are a teacher or academic teacher, we encourage you to use the materials from the course in your teaching (you can download the materials here. We'll be very happy if you do!

If you're interested in **learning more about complex systems in general**, it's worth going to the Santa Fe Institute's course called the Complexity Explorer.

If you want to **play more with different simulations**, whether related to social processes or to other domains, go to NetLogo models library and start exploring.

23. Further reading

We also recommend some books that explore both the complex nature of social world and how computational models can help better understand different social processes:

Micromotives and Macrobehavior **Thomas C. Schelling**

Simulation for the Social Scientist **Nigel Gilbert, Klaus G. Troitzsch**

Introduction to Agent-Based Modeling: with applications to social, ecological, and social-ecological systems **Marco Janssen**

Agent zero: Toward Neurocognitive Foundations for Generative Social Science **Joshua M. Epstein**

Thank you and good luck! © ACTISS