ACTISS
ACTION FOR COMPUTATIONAL THINKING
IN SOCIAL SCIENCES

THEMATIC COURSE

Why do ghettos form in a tolerant society? Schelling's model and the introduction of cellular automata

CURRICULUM

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Why do ghettos form in a tolerant society? Schelling's model and the introduction of cellular automata

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ACTION FOR COMPUTATIONAL THINKING
IN SOCIAL SCIENCES
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COURSE AT A GLANCE

Course title	Why do ghettos form in a tolerant society? Schelling's model and the introduction of cellular automata
Number of weeks/units	2
Number of hours per week/unit	3-4
Total study time	7 hours; 12 hours with additional materials
Summary	In this module we would like to concentrate on spatial segregation and a question about an inevitability of ghettoisation. It will be a pretext for introducing spatial models, with special emphasis on cellular automata. We will start from Schelling's segregation model as a very intuitive example of spatial multiagent model. It will help learners get some intuitive grasp of such models and basic understanding of modelling spatial processes. It will also show what are the basic characteristics of such models. We will start by introducing some social phenomenons in which space is important. It' s happening with residential - or wider - spatial segregation. Then we will talk about one of the best known models - Thomas Schelling's model of spatial segregation and you will have a possibility to experiment a bit with it. In the second part of the materials we will look at the models in this group in more detail from the "technical and structural" point of view, you will learn what Cellular Automata is and what it has in common with forest fire and simulation of life. Then - at the end we will keep coming back to spatial segregation and we will see what the model approach can contribute to its understanding.
Target learners	This course is designed for anyone who is interested in understanding human behaviour, especially in how different social processes work. It will be particularly useful for professionals dealing with challenges related to urban studies, migration policy, local administration. If you are studying social sciences and are curious how a computational approach works, this course will be particularly helpful. If you are an academic teacher (also when you've had no prior experience with this approach yet) and you're considering enriching your own courses, we encourage you to use the materials for your students.
Requirements / prerequisites for learners	None
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LEARNING OBJECTIVES

At the end of the course learners should be able to:

- Understand a basic concept of spatial segregation
- Discuss the problem of inevitability of ghettoisation on the base of Thomas Schelling model
- Experiment with a simple spatial agent-based models by changing the properties of the existing components and propose possible expansion of the model
- Recall and understand the main terms associated Cellular Automata models and their benefits and limitations

COURSE DESCRIPTION

In all courses within the ACTISS programme we want to provide people who identify as having ‘no brain for science’ (a fear for computation and formulas) with a very gentle introduction to Computational Social Science, to pen-and-paper formal models and to Agent-Based Models. We want to build up interest in this domain and their confidence in this area. By the end of the course we want the learners to be able to experience how modelling and simulations can help understand social phenomena and to experience how investigating a social phenomenon with the use of an Agent-Based Model works. We also want them to be aware of the potential benefits of using a computational approach to practical situations and be willing to try them out.

In this course we start from the problem of spatial segregation with its specific mechanisms is a fascinating example of a macroscale social phenomena which is not only a simple sum of individual actions - if we compare it with answers for survey questions about level of tolerance (which base on individual declarations), they cannot be translated in an easy way into results on maps. It shows that there is a need for a tool which could help us understand the underlying mechanisms of spatial segregation. Then agent based models that focus on dynamics of agents in a certain physical space - called spatial models, namely cellular automata - are introduced. We are starting from Thomas Schelling’s segregation model, then - in week two - more examples of cellular automata - game of life, forest fire. Learners are also trying to translate one model into another and bring models closer to reality. At the end we came back to Schelling's model, and advantages associated with dynamic approach to spatial segregation topic. For all of that we will use examples, animations and simple tools - no mathematical and programming skills are required!

A JOURNEY THROUGH THE COURSE

- In this module we would like to concentrate on a question about an inevitability of ghettoisation. It will be a pretext for introducing spatial models, with special emphasis on cellular automata. We will start from Schelling's segregation model as a very intuitive example of spatial multiagent model. It will help learners get some intuitive grasp of such models and basic understanding of modelling spatial processes. It will also show what are the basic characteristics of such models. It is also a case of a model that is worth studying even in its simplest version (the only characteristics of the agents are their "colour" and the level of tolerance and we have a simple definition of neighbourhood) as it makes the learners see the unobvious consequences of individual choices at the level of the population. That could also be easily translated into language of real life consequences ("Imagine, that you live in this segregated neighbourhood, does your child have a chance to play with children from another group of agents?") which could involve learners emotionally.
- This introduction will serve as a starting ground for more systematic introduction to spatial models (cellular automata). It will be presented and trained on popular and uncomplicated models (eg. LIFE - populations and resources; forest fire, evacuation models) with well documented potential of adding new elements. On the basis of these models we will show that the same conceptual apparatus allows modeling of seemingly different phenomena.
- Then learners could come back to the topic of spatial segregation and learn about more applications of cellular automata based models used for analysing different issues (forest fire, gossip)

COURSE STRUCTURE

Week 1: Spatial segregation and Schelling's model

We will start by introducing some social phenomenons in which space is important. It' s happening with residential - or wider - spatial segregation. Then we will talk about one of the best known models - Thomas Schelling's model of spatial segregation and you will have a possibility to experiment a bit with it.

Keywords: Schelling's segregation model, neighbourhood, rules of change the state, dynamics, iteration, census data, segregations maps

Week 2: Cellular automata

In the second part of the materials we will look at the models in this group in more detail from the "technical and structural" point of view, you will learn what Cellular Automata is and what it has in common with forest fire and simulation of life. Then - at the end we will keep coming back to spatial segregation and we will see what the model approach can contribute to its understanding.

Keywords: Cellular Automata, cells, iteration, grid, borders of grid, attributes of an agent, Game of life, forest fire, neighbourhood

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HOW TO USE COURSE MATERIALS?

If you want to learn:

- Start with checking out our list of Futurelearn courses available at actiss-edu.eu and pick the one you're most interested in. Courses on Futurelearn will provide you with a more user-friendly learning experience than learning by yourself with the help of our materials (progress tracking, automatic feedback to the quizzes, email reminders about the start of subsequent weeks, ability to discuss exercises with other learners etc.). We recommend starting from "Introductory course"
- For this course we have a website version, available at actiss-edu.eu. Please download the course materials (a set of materials sorted by weeks) and go through the subsequent steps: articles, videos (links to all YouTube videos are provided in the text), exercises. All the links to videos and models to be experimented with are provided within the text.

If you're a teacher:

- Check out broader instructions for teachers that are provided in the Teacher's Guide, available for each course, at actiss-edu.eu
- We encourage you to use the materials to enrich your courses: you can download all the materials for the course and use them as a whole segment or pick the ones that best suit your needs. Educational materials are divided in weeks (units) and each week consists of a series of appr. 20 small steps:
    - short articles - max.1000 words, usually followed by a discussion prompt,
    - short videos - max. 6 minutes (links are included in the text),
    - discussion questions,
    - exercises (if they relate to models, links are included in the text),
    - quizzes (2-6 questions to check student understanding)
- Some steps may be used as a homework assignment (articles, videos, exercises), some can be used within a classroom setting (discussion questions, exercises, quizzes)
- Educational materials are downloadable as a set of pdf files, each containing one week's materials and additional exercises and educational scenarios are provided in the Teacher's Guide for a certain course

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